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RUB' AL KHALI: AN ACCOUNT OF EXPLORATION IN the Great South Desert of Arabia under the auspices and patronage of His Majesty 'Abdul 'Aziz ibn Sa'ud, King of the Hejaz and Nejd and its Dependencies.

A paper read at the Evening Meeting of the Society on 23 May 1932, by

H. ST. JOHN PHILBY, C.I.E.

I APPEAR before you to-night to tell the tale of what I can describe without hesitation or qualification as the greatest and pleasantest experience of all my life. Like Jacob, who waited and worked for Rachel for fourteen years, I have worked and waited fourteen years for this moment. Like Jacob, I hoped and thought at the end of the first seven years that the glittering prize was within my reach. But on that occasion I was disappointed by circumstances beyond my control, and it was not till January of last year (1931) that I again found myself in a position to resume the assault on the Rub' al Khali. I was then at Riyadh with everything ready for the journey, but a trivial incident resulted in its postponement. And, as you all know, Mr. Bertram Thomas, taking time and opportunity by the forelock, won the laurels due to a pioneer; and I would like to take advantage of this first public opportunity of expressing my admiration of his splendid achievement and journey. I have but gleaned where he reaped so richly, and now that I have returned to seek your blessing I find myself more like Esau than his brother. I took my weapons, my quiver and my bow (or their modern equivalents such as aneroids, theodolites, butterfly-nets and what-not) and went to the field to take you venison and make you a savoury mess such as you love on alternate Monday evenings of the session. But your blessing has gone to another—the dew of heaven and the fatness of the earth and plenty of corn and wine with peoples to serve him and nations to bow down to him. . . . I can only ask you to taste also of the mess I have brought back from my hunting, and to regard it indulgently as a sort of dessert to the feast you enjoyed so much last year. In spite of the very natural pang of envy that I felt on hearing that the virgin charms of the Empty Quarter had been unveiled by another I have every reason to be grateful to Mr. Thomas, for I was fortunate enough to have his map with me during my own wanderings

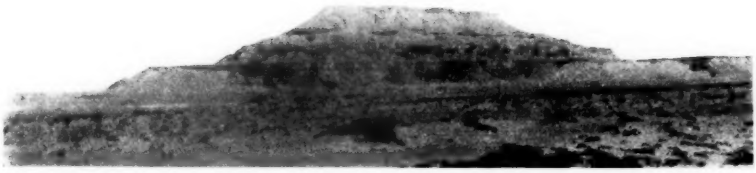
—a very fine piece of work, if I may say so—and thus to be able to attempt the little he had left undone.

And so to my story, which however I must preface by striking a double chord of regret suggested by the failure of seven years ago, to which I have referred. At that time Dr. Hogarth had just become President of this Society, and I had been elected to its Council. The coincidence seemed an overwhelmingly good omen for my long-cherished plans, and, neglecting my duties as a Councillor, I went off to Arabia thinking to celebrate Dr. Hogarth's tenure of the Presidency by an exploit which he always regarded as one of the few great prizes open to the old-fashioned explorer, who is being now so rapidly supplanted by the votaries of speed and spirit. On the train carrying me across France I had the embarrassing experience of meeting no less a person than Dr. Hogarth himself. I did not confide in him, though perhaps he suspected my purpose, and I never saw him again. It is therefore a matter of very deep regret to me that he is no longer among us to detect and expose my aberrations from the high standard he was accustomed to exact from Arabian adventurers. No man had a better right to be so exacting and no man, before or since, had a more encyclopaedic knowledge of Arabia, for which strange country he always had a peculiarly tender spot in his great heart. Assuredly, from some seat in the halls of Valhalla, his genial and critical spirit has watched the unveiling of the Rub' al Khali twice over in a twelvemonth; and I am proud to think that, in my case at any rate, his was the direct inspiration.

My second regret is that Mrs. Rosita Forbes is not here to-night to hear my first account of a great desert which has always attracted her adventurous spirit. She was to have been the companion of that first attempt on the Empty Quarter, which we planned together. But Fate ordered things differently and, to my regret, she is not on this platform to share the telling of my tale.

And now I must render unto Caesar the things that are Caesar's, my mite of homage and gratitude to the great ruler of Wahhabi Arabia, whose friendship has ever been to me more than sufficient solace for long years of exile and many disappointments. Without his countenance I had never ventured to regard the Empty Quarter as within the range of my ambition. And to his generous assistance and patronage I owe entirely such measure of success as I have achieved. It is to him that I owe the provision of the necessary ways and means for my enterprise, and that at a moment when he and his country were in the throes of the grave economic crisis which has lately been passing over the whole world. My debt of gratitude is indeed great and unrepayable, but the kinsman of Hatim Tai would be the last to wish that I should embarrass him by making a pother about his far-famed and often self-embarrassing hospitality and generosity. I would ask you therefore to regard this expedition of mine rather as a historic landmark, for it was in effect the first expedition of a scientific nature organized and equipped by the Wahhabi Government. Its results, I venture to hope, will be regarded as of world-wide interest and of some intrinsic importance.

I was inevitably the pivot on which the expedition revolved, but I was not its leader nor in any way responsible for its commissariat and other arrangements, which devolved on 'Abdullah ibn Jiluwi, the Governor of the Hasa, from whose capital, Hufuf, the expedition started on 7 January 1932. Our



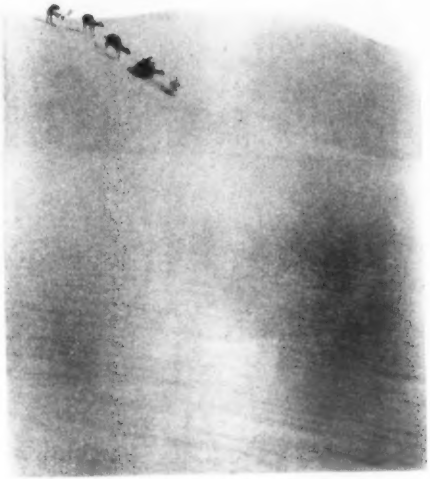
Qarn Abu Wail: 11 January 1932

Eroded rocks on cliffs of Jaub Ba'aij: January 11

Qasr and palms of Salwa: January 11

Detached block of eroded cliff near Judairat wells: January 13

'Ali ibn Salih ibn Jahman, the chief guide, at Maqainama: January 24



Camels descending slope of dune range near Tuwairifa wells: January 31

Detached block of eroded cliff near Jadairi wells: January 13

at Maqainama: January 24

Tuwairifa wells: January 31

leader was one Zayid ibn Munakhkhas, a man of the Bani Hajir tribe who had long been in the service of Ibn Jiluwi; and our party, which I actually joined by car at the wells of Dulaiqiya some 10 miles south-east of Hufuf, consisted in all of nineteen persons and thirty-two camels in the very pink of condition, as they well needed to be for the task that lay before them. With only a few exceptions all our animals were of the 'Umaniya race, the best of all Arabian camel strains; and furthermore they were all what are known as Ramliyat or sand-bred camels as opposed to those of the steppe-desert, which indeed have many virtues but are as little at home in a region of eternal sand as our own animals ultimately proved to be on the steppe and rock into which in due course we passed on the conclusion of the main part of our programme. It was then something of a revelation to see how gingerly they trod on the hot sharp gravel and rock of the western steppes, on which the bare-footed Arabs of our party would walk and run with complete unconcern while my own tender feet were full of practical sympathy with the camels. Never before had I had an opportunity of observing Arabian camels under such a searching test of their reputed merit and powers of endurance as that provided by the ninety days of our wanderings across Arabia by way of the Rub' al Khali. Two of them we slew and ate in due course, while another we abandoned in the middle of the desert when it went irretrievably lame. Of the remaining twenty-nine we sent back fourteen with eight of our men and the heavy baggage by the easiest route to Riyadh after two months of wanderings, and they duly arrived safely at their destination about a fortnight later. The remaining fifteen, specially selected for the crossing of the waterless desert, together with eleven of us and a Saluqi hound picked up by us at Jabrin, saw the whole thing through from beginning to end. They were a sorry sight indeed on arrival at Mecca on the ninetieth day, thin and humpless and mangy. But they had done their job, and done it magnificently under conditions of drought and short commons such as only the best camels of Arabia could stand. They had vindicated a much-vaunted but seldom-tested reputation, and on some of those ninety days they stood up to hard merciless driving in a way which I should never have thought possible. It is difficult to feel any sort of affection for the camel, but admiration is the least due of those animals to which in so large measure we owed the successful issue of our venture. On one occasion they went for over forty-eight hours without a morsel of any kind of food, and ten days without water was the record of the best of them in the third month of our wanderings, during which in all they covered 1800 miles in ninety days—surely a magnificent marching record.

As regards the human element of our party, I have already mentioned the leader Zayid. His deputy was the chaplain, whose primary function was to conduct our prayers and cure our souls; and besides these two we had five servants to minister to our many and various needs. The remaining eleven, that is to say the bulk of our party, were tribal shaikhs or scions of shaikhly houses, of whom six represented three sections of the Murra while three were from the 'Ajman and two from the Manasir. These eleven were, of course, the most picturesque and interesting features of the party, but they were by no means an easy element to pilot through the desert, and often enough we had serious trouble and friction when their independent and individualistic spirits

came into conflict and argument with each other or with me. In general, I came in due course to regard my eighteen companions as a solid mass of primeval inertia resolutely thrown into the balance against any and every proposal involving any sort of risk or hazard, while the momentum needed to propel it in a forward direction was provided by a curious combination of greed of gain and fear of the consequences of failure, for every man of them was frightened to death at the very thought of Ibn Jiluwi's possible wrath, and three of them had only recently emerged from the prison to which he had consigned them for some stupidity. Thus by threats and cajolery in about equal proportions I was able step by step, and each time only by the very skin of the teeth, to accomplish the objectives of a steady relentless purpose reinforced by the energy provided by my native obstinacy. I must confess that after ninety days of such unremitting conflict I began to grow rather weary of my companions and was glad enough of a respite from them. But when I look back on those early days of our adventure and remember the tones of awe and horror in which they spoke to each other over the camp fire or on the day's march of the dreary prospect before them, I marvel that we should, after all, have held together for ninety days and accomplished so much that was then cursed so freely and loudly as the stuff of dangerous dreams or raving madness. Such names as the Empty Quarter and Hadhramaut (the abode of death) passed from lip to lip in those days like words of evil omen, generally whispered behind my back but ever and again shrieked aloud in an agony of senseless terror. It was all very depressing and disturbing, while friends who had seen us off from Hufuf had not improved matters with the almost tearful farewells by which they seemed to give expression to their conviction that they would see us no more; in addition to which our start took place under climatic conditions as dismal as one could well imagine. A heavy mist obscured the cheerful world of towns and palm-groves as we moved out into the cheerless unknown, and for the first three or four days of our march the cold was intense and my ill-clad companions suffered cruelly. Each night the water in our skins froze hard and had to be thawed by the camp fire before we could make our morning tea and coffee. And finally, as if to bring our tale of woe to a climax, the fast of Ramdhan began on the third day out, condemning us to thirty hungry days with nothing to eat or drink from an hour before daybreak till sunset. The law of Islam of course allows the *bona fide* traveller exemption from the fast, which may be undergone at some more convenient time, but from the beginning it was decided that we should not take advantage of this relaxation, and we duly fasted day by day. As a matter of fact only four of us, including myself, actually fasted the whole thirty days without a single break, while the rest ended up with debts of from two to ten days to make good when they got home. The ordeal of the fast is not really as terrible as it may sound except to those who eat and drink excessively during the night. After about twenty days of it one begins to feel a little weary at the sense of restraint, but then one can begin to count the days remaining and to hope that there will be only twenty-nine instead of thirty, while when that hope is disappointed there is but one day to go. Hunger one simply does not feel during the day after a very unappetizing meal of plain rice cooked in butter taken at about 4 a.m., while thirst can easily be subdued by a restrained use of liquid during the night hours. In my case

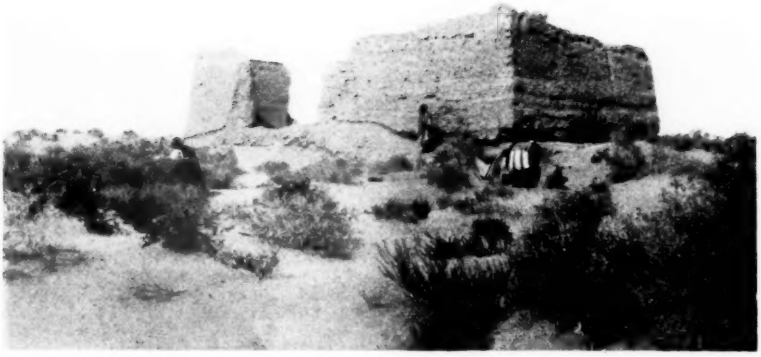
I avoided water altogether and continued the practice far beyond Ramdhan, with the final result that I did fifty-five days without a cold drink of any kind, my substitute being tea and freshly drawn camel milk (warm and frothing). During this period I never experienced thirst, and I would have continued it to the end had not my supply of tea run so short that I had to use the same tea-leaves over and over again for three or more brews, while naturally enough the supply of camel milk became less and less plentiful and I had eventually to give up my private cow to the community. During Ramdhan I contented myself with two small pots of tea, one at sunset each day and the other after the pre-dawn meal, and a bowl of milk, while some of my companions made their fasting hours a real penance by drinking long draughts of water at sunset and during the night. Thus Ramdhan served to reduce the common stock of courage and cheerfulness, so badly needed for the critical stages of our journey, and it was only little by little as we progressed and found the bogey less terrible than it had seemed from afar that my companions began to become more optimistic without however evincing any desire to spend a single day longer than absolutely necessary on the dreary business we were about.

Our programme envisaged as complete an exploration as might be possible of the Jafura desert, which is in effect an extensive northward continuation of the sands of the Great South Desert reaching from the line Jaub–Jabrin to within a few miles of the Hasa oasis and skirted on the east by the estuary-like depressions known as Jiban. I cannot now spare time for more than a very few remarks on this interesting tract, which occupied our attention for the first fortnight of our wanderings. We first travelled south-east across the most northerly part of Jafura to Salwa at the south corner of the Bay of Bahrein, whose position was fixed by Major Cheesman in 1921. On the way we traversed the more northerly of the Jiban depressions (Hirr and Ba'aij), which with those farther south and extending inland possibly as far as Jabrin itself would seem to be the site of an ancient and enormous estuary of the sea in Miocene and perhaps even later times. Between them and the present line of the Persian Gulf coast extends a vast tract of very low-lying Sabkha or salt-marsh, which would seem to be the dry bed of a comparatively recent lagoon separating the Qatar peninsula from the mainland. Indeed, farther south than the lines on which I crossed it, Mr. Thomas last year found a considerable lake in the part known as Sabkhat 'Amra; and doubtless such a phenomenon may occur in other parts in seasons of unusually high tides or after a good fall of rain, as all this area appears to be a little below sea-level. But I saw no lakes, and my Badawin, who knew all the Qatar district well, did not think that there were any permanent sheets of water in the neighbourhood, though I see no reason for disbelieving such a possibility, as any large sheet of water such as that seen by Mr. Thomas would obviously take a long time to evaporate and would be reinforced from time to time by rains or tides. At any rate the whole tract is quite obviously the site of a recent lagoon, on the banks of which are to be found, I was told, the remains of an ancient city. But those ruins lie farther south than Mr. Thomas's route, and I must leave them to be considered when we come to Maqainama. From Salwa, which Major Cheesman has fully described, I made for Sikak in the hope of finding ancient ruins as suggested by vague Badawin reports. I found however no sign of them, though on a spur of the

Qatar hills facing the miserable little oasis I found my first flint implement and a rich deposit of fossils of Miocene age. From there we recrossed the salt-plain, on which we cut the tracks of a solitary Ford car which had distinguished itself last year by performing successfully the prodigious journey from Mecca to Abu Dhabi.

Our next important halt was at Anbak, a little oasis which was also supposed to have been a settlement of antiquity. In this case I discovered that the reputed ruins were nothing but remnants of rock of fantastic shapes surviving from cliff-erosion in the past when the sea must have extended up the valley or Jaub of Anbak. In the exposed cliffs I found vast deposits of fossils similar to those of the Qatar hills, and these I followed up to the point where they pass under the floor of the modern desert, whose non-fossiliferous sandstone strata give no clue to their geological history, though its vast surface of pebbles, shingle, and gravel strongly suggest that at one time it was a maritime beach. Visiting a well here and a well there we re-entered the sands of Jafura, in which we marched hard for the next three days in a south-westerly direction, crossing incidentally the ancient river-bed of Wadi Sahba, of which I was told that it runs into the sea at a point close to the single well of Batha in its actual bed. Jafura is a great desert of rolling sand-billows seldom more than 100 feet or so in height and generally overlying, as we could judge from frequent exposures of the floor, the same vast pebble-strand of which I have already spoken. Beyond its western fringe a gravel steppe extends far back to the Summan uplands, and in the midst of this steppe we came upon the great basin containing the famous oasis of Jabrin. That basin extends eastward from the foot of the Summan and is known as the Juba until it passes imperceptibly into the valley of Jaub al Budu', which in its turn becomes lower down the Jaub (*par excellence*). It is difficult to resist the conclusion that the Jabrin district with its shallow brackish wells, its frequent strips of salt-plain, and its gypseous sub-surface, lay at one time at the head of the estuary to which I have referred. When that was we cannot say, and we must not speculate whether it was within human times or earlier until the desert surface above the Miocene strata yields up the secret of its geological age. So far it has resolutely refused to produce a single fossil, and my search for such evidence has been in vain. It may however be suggested as a possible theory that the post-Miocene strata of eastern Arabia (including the Summan, the Hasa province, and the Jabrin–Jafura tract) are of aeolian formation rather than marine.

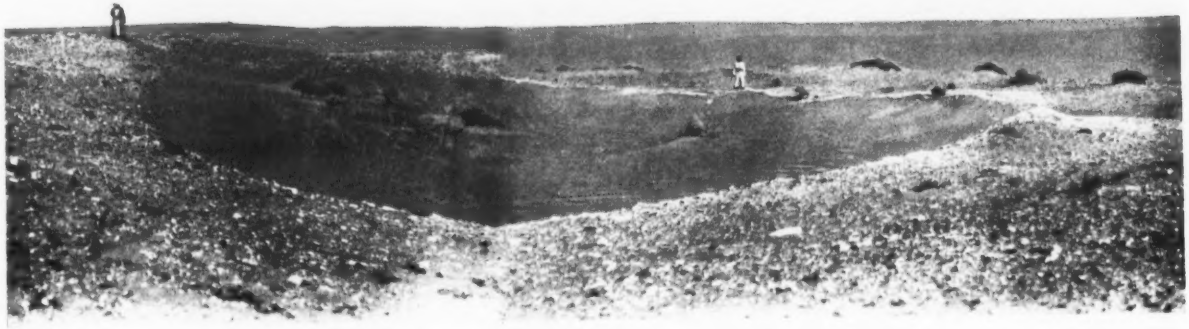
Up to 1924 no European had ever seen Jabrin. In that year Major Cheesman visited it, mapped it, and collected specimens of all that it contained; and I must not be tempted into any long description of a spot that is at once so interesting and so hideously dismal. I was glad to get away from it after three days of intensive exploration, during which I found myself breaking imaginary lances of controversy with Major Cheesman, whose map got me into serious trouble with my guides, who were absurdly touchy and ultimately, I must confess, proved to be in the right. The trouble arose when we arrived at a tiny village and oasis called Khin, which Major Cheesman claimed to have visited and which accordingly he placed on the map in the neighbourhood of two little palm-groves called Umm al Nussi and Umm al 'Adhwa. He must clearly have been misinformed by his guide and could never have seen the



Qasr ibn Dahbash, Jabrin district: January 21

Dharbun ridge, south of Jabrin: January 22

Pitching camp on arrival at Wabar: February 2



Exposed crater at Al Hadida (Wabar); composite photograph

Camp near Shanna well; exposed gypsum cliff on right: February 20

place which lies, as a reference to my map will show, half a day's journey east of Jabrin and not a mere hour or two south of it. In other respects also, and notably in the matter of place-names, I found Major Cheesman's map in need of considerable correction, while I am at a loss to understand his rejection of the locality called Haradh as a figment of my earlier imaginings. I was not able to visit it, and its exact position on the map must still be left a little vague, but I was able to ascertain two facts about it which sufficiently prove its real existence reasonably near the position assigned to it by me many years ago on the authority of Arab reports. In the first place the well of Haradh was for a considerable period the headquarters of Ibn Sa'ud during the military operations of the year 1900, which resulted in the dramatic recovery of Riyadh. And, secondly, Haradh in modern times lies on the new motor road from Hufuf to Jabrin.

It was at Jabrin that we bade what was to prove a long, long good-bye to the human race, and it was not till we reached Sulaiyil, fifty-three days later, that we again looked upon the sons and daughters of men. The tracks of our very superior sand-camels had attracted to our camp a man of the Murra tribe, who had come up from beyond Shanna with his forty grazing camels, his wife, and two completely naked children, travelling by easy stages from well to well on his way to the more prosperous pastures of northern Hasa. He was curious as to the inward meaning of such an expedition as our tracks proclaimed, and he had taken it for granted that we were southward bound on mischief intent. He was indeed able to inform us that the rumour of our coming had already preceded us by the mouth of Saif ibn Tannaf, shaikh of the Manahil, who had actually been at Hufuf when preparations were being made for our expedition and had promptly gone off to warn the desert of our coming. He therefore prophesied, and rightly prophesied, that we should find the desert deserted by all humanity, as all the grazing tribes had, when he came north, been making preparations for an immediate withdrawal to the safe shelter of the southern mountains. It was by no means good news from our point of view as we had every desire to get into touch with the Rashid and Manahil with a view to a southern extension of our wanderings in certain contingencies, while Mr. Thomas's guide of last year, Hamad ibn Sultan, who was living with his married daughter among her Rashidi in-laws, was regarded as likely to be of service to us, our chief guide being his near cousin 'Ali ibn Jahman. However we thanked our friend Jabir ibn Fasl for his news and annexed the Saluqi hound already referred to to hunt hares for us in the desert, while I seized the excellent opportunity of handing over to him for delivery to the Governor of the Hasa a heavy box of fossils and other things representing my collections up to date. Two months later, at Wadi Dawasir, I heard a rumour that he had been raided by a party of brigands from far Najran and robbed of all that he possessed. I thought sadly of my precious fossils, but in due course they arrived intact at Mecca and are now safely at the British Museum, though the story of the raid was perfectly true. What had happened was this. My friend, having received a small present of money for his trouble, was anxious to spend it, and so went down with it alone to the Hasa, taking my box with him. To his wife and naked children he had confided the camels with instructions to go and graze them in the Dahana pastures until he should

rejoin them with the little luxuries which would delight their hearts. The brigands found them alone and defenceless and took all the camels except five, which they courteously returned to the hapless woman for the maintenance of her family. And the husband in due course returned to find himself a pauper. Such are the tragedies of the desert!

And now, before I finally quit the haunts of men, there is just one little point on which I must join issue with Major Cheesman, who has stated that "the Badawin language is very different from Arabic, and I had much difficulty in understanding it." He was referring to the Murra tribe, of whom I had no fewer than six in my party, while during the fortnight of our Jafura wanderings I saw and spoke with numerous other individuals of the tribe, including a number of its ladies, who on one occasion came to me in the form of a deputation to protest against the removal of their pet Saluqi hound by my companions. Needless to say, I was not privy to the crime, and very soon rectified the matter by restoring the dog to its owners, but I shall not soon forget the eloquent pleading of the ladies reinforced by the piteous howling of their children. I can only say that in all my experience of the Murra I never heard them speak any language but Arabic, whether they spoke to me or to my non-Murra companions or among themselves, while the Arabic they spoke was of that pure and beautiful kind which one is tempted to call classical. Their pronunciation indeed reminded me strongly of the speech of the Hejaz mountains, though in this respect the speech of the even more distant Manasir seemed to be nearer that of the Hejaz and eloquently proclaimed a common origin. For the moment I must content myself with noting the tendency to pronounce the letter *j* as *y*, as, for instance, in the names of the Manasir capital shown on our maps as Liwa, which is Al Yiwa for Al Jiwa or Al Jua. The Arabic letter *dhad*, fully pronounced in Nejd, is also softened to *l* by both Murra and Manasir as, for instance, in Haral for Haradh and *la* for the demonstrative *dha*. The difficulty of understanding the speech of such people arises more from the fact that in the realm of thought they are poles apart from the so-called civilized man who speaks in prose while the Badawin spout poetry without self-consciousness. If you call to a man he will not reply "What?" but "May you rejoice," or "Here am I."

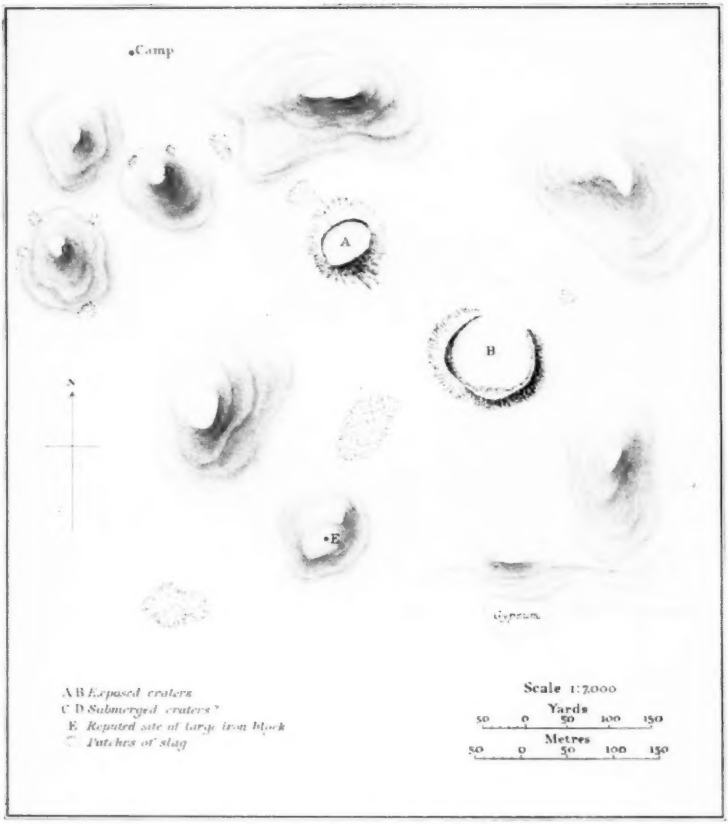
It was on January 21 that we left Jabrin in quest of Maqainama, the first item on our Rub' al Khali programme. I see that some of our newspapers have referred to this place as the capital of the ancient kingdom of Magan, and, before I introduce you to its ruins, I must as briefly as possible explain what was known or conjectured about Maqainama before the time of my visit. Mr. Thomas did not even mention it in his book and may not have heard about it, while the credit of making its name known to the public belongs to Major Cheesman, to whom in 1923 it was described as an immensely deep well. That was in fact the truth, the whole truth, and nothing but the truth about Maqainama. Major Cheesman was not however content with that. He had come upon a fragment of granite near Jabrin. He knew of no granite like it nearer than Egypt, while subsequent research satisfied him that Maqainama was probably none other than Magan, the capital of an ancient kingdom in intimate commercial touch with the Sumerians of Mesopotamia, who drew their supplies of diorite (and presumably granite, etc.) from here for the use of their

sculptors and architects. It was difficult to imagine Maqainama (so far inland) as a seaport, though I have already shown that at some time in the past Jabrin must almost certainly have been on an arm of the sea. At any rate, Major Cheesman assumed that the exports of Maqainama went by camel-caravan and that his granite fragment had fallen by the way. And that was all we knew about it for the time being, while now, after my visit, we know a great deal less. It is curious that Major Cheesman, having struck upon the name of Magan, should have been at such pains to link it up with the somewhat similar name of Maqainama, when a study of the map of eastern Arabia would have led him on the very shores of the Persian Gulf itself to a place called Majann, which is indeed the spot to which I have already referred as a reputed site of ancient ruins. It is pronounced Mayann or Magann by the Arabs of to-day, and it certainly has better claim than Maqainama to the honours accorded to the latter by Major Cheesman. As for the granite affair, I have picked up numerous fragments of such rock in almost every part of Arabia from the very shores of the Persian Gulf right across to the Red Sea. In fact, a good half of the exposed surface of Arabia is of igneous rocks, and the fragments found in the gravel-beds of the east have clearly been brought there not by laborious camel transport but by the rivers which once flowed across the great peninsula.

Maqainama (incidentally I was at the time exceedingly sceptical about the very name of the place as reported by Major Cheesman, though on that point I was wrong and he was right) is situated about 70 miles due south of Jabrin. The intervening country represents a sort of transition from steppe to sand and consists of wide alternating strips of the one and the other, a dull, dreary country with good pasturage in favourable seasons. In it hares and other game abound, and we found a single complete but broken ostrich egg *in situ* to remind us that before the advent of modern firearms that great bird was an inhabitant of these parts. It became extinct here about forty or fifty years ago, and is now confined to the deserts of northern Arabia around Jauf. Our course took us past three wells (Qaliba, 'Uj, and Bir ibn Juhaiyim), and we in due course traversed the broad gravel plain between the sands on the left and the Summan steppe on the right to arrive at Maqainama, a single beautifully constructed well of excellent sweet water at the immense depth of 171 feet. A few miles out in the Summan I found a bronze arrow-head, while the well-marked camel tracks leading west to the Aflaj (four days' journey with a single well called Jabaliya about halfway) and east to Bir Fadhil and possibly beyond to ancient Majann (?) encouraged me to think that I was on one of the old trade routes connecting south and east Arabia with the northern and western marts such as Mecca and Petra. It was quite obvious that the legendary city of Wabar, which was the next item on my programme, must lie on some such route; and you can imagine my growing excitement at the first small clues that came to my notice. I refused to let myself think in terms of Petra or Tutankhamen, but my dreams these nights were nightmares of immense vistas of low single-story barracks in perpetual motion, on which I vainly strove to take rounds of angles with a theodolite perched on a moving floor. From Maqainama we struck east for Bir Fadhil and immediately entered the great sands of the Rub' al Khali, or that part of it which is known as Ar Rimal; and from that day on for a month or more I observed that all the world was in a state of perpetual flux. It was

an astonishing experience. Nothing was steady. We had embarked on an ocean where the winds dictated the direction of the restless waves. Forward they moved or backward, or to right or left, but always they moved with only one relatively constant factor due to the prevailing and alternating north and south winds. All the ridges and valleys seemed to lie roughly north-east by south-west, and there was another feature of these sands which intrigued me. On the darkest night (provided that the sky was unclouded, which it generally was) one could see with astonishing clearness the light of the brilliant stars being apparently reflected by the crystal sands so that the air became luminous. Venus and Jupiter threw shadows as clear-cut as the moon's, and one night in particular I shall never forget. The half-moon stood halfway between the two great planets while a brilliant meteor streaked across the southern sky from west to east. The stars paled into insignificance before such a display, and it was light as day. Around us stood the peaks of shimmering sand like mountains of snow.

We came to Bir Fadhil on the third day after an easy march over a gently undulating tract of broad sand-ridges frequently interrupted by long wide streaks of gravel. The wells themselves are situated in the midst of great soft dunes and are 120 feet deep with excellent water like that of Maqainama. From here, on January 29, we again turned south in accordance with my general plan of following the westernmost line of wells which, according to my guides, formed the dividing line between the tract of Ar Rimal and the Rub' al Khali proper. And I must here turn aside from my narrative to discuss briefly a point of considerable geographical importance. Both Major Cheesman and Mr. Thomas have stated that the term "Rub' al Khali" is not used by the local Arabs (*i.e.* the Murra tribe) in a geographical sense and that the huge area which has so long been distinguished by that name on our maps is in reality called Ar Rimal (meaning the Sands), while the sub-title of Al Khiran (the salt wells) is used of a part of it containing numerous wells of exceedingly salty water on which men and animals can exist during the grazing season. Now I had with me six persons of the Murra, including two of the Dimnan section, whose habitat extends from Najran across the great waterless desert to Jabrin and Ar Rimal. They used the term "Rub' al Khali" quite freely, though, perhaps, in a sense somewhat more limited than that given to it in our maps. They frequently used it to dissuade me from my plan of travelling west, while they had no objection to wandering about as much as I liked in Ar Rimal. The distinction they make between the two tracts is not unlike that which we make between the desert and the sown, except that by the "sown" they understand the pastures and wells of Ar Rimal, while the Rub' al Khali is the empty land, the land without water, without pastures, without inhabitants, nomad or otherwise, without anything. I made a point of noting verbatim every sentence in which the name cropped up, whether in conversation with me or among themselves. On the whole the name was on their lips perhaps more frequently than Ar Rimal, while sometimes they also use the term "Mahmal" or "Mahamil" to indicate the waterless character of the tract. Time does not permit of lengthy quotations from my notes, and I must content myself with a single short one, which seems to dispose of the matter in a suitably epigrammatic form. "Yaum ghada ma fih ma, ghada rib'an khali; ma ahad yajih," they said, which being



Plan of Al Hadıda (Wabar) from a sketch by H. St̃. B. Philby

Camels grazing on sand-slopes near Naifa: February 15

Hadhat al Hawaya in the waterless desert, where breakdown of transport animals compelled retreat to Naifa: February 26

Naifa; camp, well, and singing sands: March 4

interpreted means: "Where there is no water, that's the Empty Quarter; no man goes thither." Yet that was just where we were going or planning to go, and for the moment I was engaged on the task of visiting and placing on the map all the wells that formed its eastern boundary. My considered conclusion is that the whole of the Great South Desert should be regarded and labelled as Rub' al Khali, while the term Ar Rimal should be reserved for that part of it which is frequented by the Badawin graziers owing to the presence of numerous wells.

On the second day from Bir Fadhil we reached Numaila, a buried well which one of our men had once visited twenty years before, when he was a youngster. He remembered that on that occasion he had buried in the sand the toys which he and his companions had used in playing a game called Darraj, apparently a sort of tiddlywinks. He went to the spot after all these twenty years, and, sure enough, the toys were still there. He brought them to me for my collection. On the way to Numaila we had crossed a wide gravel plain in the midst of the sands, and my attention was attracted as we marched by a white object. In a moment I had called a halt, and for the next two hours the whole party was busy collecting freshwater shells from an immense deposit, and not only shells but a splendid lot of quite beautiful flint implements of ancient man. Here was obviously a valuable clue to one of the problems which I had come to investigate. Ancient man had clearly frequented this spot, which from the evidence of the shells and from that of the alluvial silt in which the deposit lay, seemed to be a river or lake bed such as I should have expected to find in the desert east of the great drainage channels which I had crossed fourteen years before on the way down to Wadi Dawasir. The shells themselves will doubtless give a suitable explanation of their origin, but I went on rejoicing at the thought that I had discovered the lower course of one of those old rivers, probably that which is represented 300 miles farther west by Wadi Maqran and the Aflaj drainage lines which presumably join it in the now waterless wastes. Ancient man had evidently enjoyed good duck shooting on this river, or perhaps he came down to lie in wait for the gazelles that came to drink. I had another reason to rejoice. If this was the Maqran, there was no reason why we should not meet Wadi Dawasir farther south, and what more natural than that Wabar itself should be found on its banks. That would have made havoc of an old pet theory of mine, but the facts had to be faced, and on we went. Before reaching Tuwairifa I turned aside to examine a gravel-patch in the hope of finding more flints, and I found exactly what I wanted, but I also found myself standing on the mouth of a well, of whose existence my companions had no knowledge whatever. According to them the sand must have receded from this spot and uncovered an old and unknown well, so we gave it the name of Bir Maqran, to indicate the theory I had formed about the channel in which we still appeared to be. Tuwairifa (five wells) farther south continued the series, and at some distance from it, as we marched east towards Wabar, we came upon another unknown well which we named Bir Mukassar from the sand-ridges of Bani Mukassar around it.

From this point we marched for two days across a swelling ocean of sand, of which the ridges were the waves, and on February 2 we reached Wabar. So far everything had led very nicely and naturally up to the climax. Ancient man

had been in these parts. A river had flowed through this wilderness. And there were plenty of wells, while at Tuwairifa we had seen well-marked caravan tracks like those at Maqainama and Mr. Thomas had seen similar tracks far to the south-east. I must now go back to link up the ruins before which we stood with their previous history as known from ancient legends and from the tales of the Badawin who had actually seen them. Last year Mr. Thomas was shown the "road to Ubar," and was told of what he took to be columns, also of a mysterious piece of iron. His story is doubtless familiar enough to you, and it seemed to me to bear out in broad outline what I had heard fourteen years ago from several sources, including a man of the Murra tribe who had clearly seen what he described to me. On the evidence so gathered I had come to the conclusion that there were two localities in question—a locality with the ruins of ancient human habitations and another with a strange large block of iron described to me as being about as large as a camel. I put those two places very provisionally on the map to indicate the positions assigned to them by Badawin vagueness, and I have been duly taken to task for my boldness. It is curious that Mr. Thomas also had very much the same tale of two sites represented respectively by ruins and a block of iron. And it is still more curious that, as we approached the place itself, I still had quite a definite impression of two sites, though it began to be clear that they were closer together than I had originally supposed. The fact was that one guide knew only the ruins and had never seen, though he had heard of, the iron, while the other was confident he could lead us to the iron, though he only had a very vague recollection of the ruins, which were said to be often enough so completely covered by the sands that it was quite problematic whether we should see them. The name of Al Hadida was applied to the iron and rather vaguely also to the ruins, while the well of Umm al Hadid at some distance eastward also referred to the same phenomenon, and my chief guide generally spoke of the ruins as Al Iqsar, a name which is familiar enough to visitors to Egypt in the Europeanized form of Luxor. The name Wabar comes from semi-classical legend and is applied to these ruins in the Empty Quarter by the town-dwellers on its fringes, as, for instance, at Wadi Dawasir and in the Hasa, but the Badawin proper, who know the name well enough from their poems and legends, do not use it of the ruins though they make no doubt that the remnants at Hadida do represent the ancient city of 'Ad ibn Kin'ad as there are no other ruins to be found in the desert. So they said, and so they led us on to win the money rewards I had announced my intention of paying—thirty dollars for the great lump of iron and five dollars for each separate building discovered. At this stage and on the very day we were due to arrive on the scene our chief guide, thinking to pocket all the rewards for himself, gave us the slip on a solo voyage of discovery, and left his rival to lead us through the desert. Late in the day the truant reappeared with an announcement. He had found the place and he had never before seen so much of it free of sand, though he had not seen the iron. He then produced from under his cloak a specimen from the ruins, a large square brick of vitreous appearance with numerous air-bubbles such as would result from burning. So it was true, I thought, that the place was consumed by fire as suggested by the legend. And we marched on till the ruins came into sight, a long black wall, as it seemed, riding on the sands. We drew

nearer and halted at a suitable camping spot, while I immediately hastened to the top of a low sand-hill near by to get a good first view of the site before dark. The great moment had at last arrived, the moment I had longed for for fourteen years, and I found myself looking down on the ruins of what appeared to be a volcano! So that was Wabar, the city of a wicked king destroyed by fire from heaven and thenceforward inhabited only by semi-human monomembrous monsters. A volcano in the midst of the Rub' al Khali! And below me, as I stood on that hill-top transfixed, lay the twin craters, whose black walls stood up gauntly above the encroaching sand like the battlements and bastions of some great castle. These craters were respectively about 100 and 50 yards in diameter, sunken in the middle but half choked with sand, while inside and outside their walls lay what I took to be lava in great circles where it seemed to have flowed out from the fiery furnace. Further examination revealed the fact that there were three similar craters close by, though these were surmounted by hills of sand and recognizable only by reason of the fringe of blackened slag round their edges.

My companions were soon busily engaged in digging into the ruins for treasure, and nothing I said could stop them. Their saddle-bags were soon filled to bursting with the little jet-black shining pellets which strewed the place and which they took for pearls, the pearls of the numerous ladies who, according to the tradition, had graced the court of King 'Ad and perished in the flames. Two months later these relics were going the round of the market at Mecca with disappointment in their train, but to this day my companions believe that the ruins we saw were indeed the ruins of a great city. Yet the truth is that, after all we had already seen of flint implements and other evidences of ancient man, this locality failed to produce the slightest vestige of human occupation, temporary or otherwise, modern or ancient. The nearest water was 10 miles away at Faraja, and the river I had hoped to find was nowhere to be seen. The secret of Wabar was out at last, and all that remained to do was to search for the iron "as big as a camel." It was like searching for a needle in a haystack, and I thought it best to leave my companions to it while I went down with the camels to make contact with Mr. Thomas's route at Faraja, and thence to Umm al Hadid and Ibrahima, where we spent a night watering the animals.

On the way back by a different route we met a solitary hoopoe going north, while some days earlier, near Numaila, we had passed a single swallow: strange birds to see in these desolate parts. Recrossing Mr. Thomas's line, which my guide had no difficulty in locating by the droppings of his camels, though his tracks had long been obliterated by the driving sand, we returned to Wabar, where the rest of the party had to confess to failure in their search. They had found a silly little fragment of iron, but it was not as big as a camel, so they had not worried about it. I sent somebody in search of it, and he duly brought it along. It was about the size of a rabbit, but I have very little doubt that it was the very thing we had come to find. Legend had magnified it as we still magnify fish. It is conceivable, of course, that a larger fragment of such iron lies somewhere about upon those sands, but this was good enough for my purposes. The camel had gone through the eye of a needle with a vengeance, but the meteorite (for that is what it was) will doubtless be of some interest to the experts. It was

immensely heavy, as the camels had good reason to know for the next month or more, and its dimensions were $27 \times 9 \times 9$ centimetres. So, for all practical purposes, we had found the iron and we had found the ruins. The two localities had merged into one, and the distance between it and one of the sites I had selected for it on the map fourteen years ago does credit to the man who then guided me to the place in imagination. He had spoken of it as Al Hadida (which I translated "a lump of iron") in Jafura, and I erroneously gave the latter name to the locality without realizing that the former was itself a proper name.

The discovery of such craters in a position so unexpected was perhaps sufficient compensation for the failure to find the ruins of a great city, but we had tracked the rumour of its ruins to their source, and I at any rate have done with the search for Wabar. That quest I bequeath to younger folk with the warning that now there is no more reason to suppose that any city ever existed in the vast expanse of the Rub' al Khali. The piece of iron, to which I have referred, has provided the necessary clue to the character of the Wabar craters; and Dr. Spencer of the British Museum has been able to establish beyond any possibility of doubt that it is part of a large mass of meteoritic iron whose impact upon the earth gave rise to the craters. The slag-like material surrounding the latter proves to be silica glass or sand fused by the tremendous temperature generated by the falling meteorite; and it is satisfactory to know that, according to Dr. Spencer, the material brought back by me from Wabar provides conclusive evidence of the formation of craters on the surface of the earth by meteorites. The number of such craters previously known is so small and the evidence provided by them was of so problematic a character that the existence of meteorite craters was perhaps open to some measure of doubt until further confirmatory evidence should be forthcoming. But Wabar, while it has failed to confirm an Arabian legend, has made amends for such failure by providing the necessary proof of a scientific theory. And it is a curious coincidence that the single issue of the *Geographical Journal* which I carried with me into the desert (because it contained Mr. Thomas's map and the text of his lecture before this Society) contained a paper on a supposed meteorite crater at Bosumtwi in Ashanti, which led me to form on the spot the provisional conclusion that, assuming my piece of iron to be of meteoritic origin, the Wabar craters might be of meteoritic formation. I did not then know how rare such craters were, and still less did I suspect that the same issue of the *Journal* contained, in a note by Mr. W. Campbell Smith, a description of a larger piece of meteoritic iron from Arabia which, from the details of the story of its acquisition by the British Museum in the year of my birth, would seem to have originated from these very craters of Wabar itself! At any rate we had now disposed of an important item on our programme, and the future was somewhat vague, while a sense of anti-climax weighed upon us and particularly upon my companions, who had seen their hope of dollars turned to dust. We marched south over the bare swelling plain of the Sanam tract, leaving the wells of Tasrat, Ma'shiya, Judair, and Faris to the left about halfway between us and Mr. Thomas's route, farther east. The month of Ramdhan dragged wearily to its close with an occasional mild sandstorm to vary the monotony. Amid the deep valleys and parallel ridges of Sawahib we actually came upon a butterfly, and then

Members of the Rub' al Khali expedition at Naifa: March 5

Marching along dune-range of Bani Zainan to find a suitable point for crossing: March 8

Waterless desert; Sahma gravel plain looking north to dunes of 'Awariq: March 9

Rumaila sand-tract; giving a camel drink through the nose: March 12

Sulaiyil; hamlet of Al Hanaish: March 15

Wadi Dawasir; camp in front of main entrance of Barzan, governor's residence: March 18

we began to see fairly recent traces of oryx, though our eager hunters ever returned unsuccessful.

On February 8 we reached 'Ain Sala, a buried well in the deep hollow of a lofty horseshoe dune, where we got a fox and saw the tracks of a stone curlew, while one early morning a flight of fifteen geese or swans went flying northward over us. From here we visited the well of Adraj about 10 miles to the north-west, and then we went to Naifa to water the camels from its shallow well of violent purgative character. We were now marking time until the scouts we had sent forward to look for Arab encampments to the southward should return, and one afternoon as I lay in my tent in the deep sand-bound hollow the slopes around us began to boom. Once before, in 1928, I had heard singing sands near Badr on the Madina road, but from afar. Now we were in the very midst of the concert which had been started off by one of our party walking up the steep sand-slope to keep a look-out. Again and again the phenomenon repeated itself, each bout of the deep droning music lasting about three or four minutes before it petered out. I immediately went up to the summit of the great dune, where a very gentle breeze was blowing from the north, while the sun shone hot and strong upon the sand. I found I could produce the desired effect practically at will by setting large quantities of the sand in motion with my feet. The sliding mass began with a soft grating sound which gradually developed into the deep musical booming as it got lower, and then as gradually the tone softened until it stopped abruptly when the sand ceased to move. On one occasion, having got the music going strongly, I threw myself down the steep slope and almost buried myself in the deep moving sand, which seemed to vibrate and throb under me, but continued singing. I plunged a bottle into the singing mass to collect a genuine sample, and as I withdrew it a long-drawn-out wail as of a trombone followed it. The same thing happened when I tried to disengage my deeply buried knees. I would suggest that this effect is achieved by the formation of a sort of vacuum between the moving mass and the stationary sand over which it passes, the hollow space serving as a sounding-board to convert the initial grating into the final booming. Next day, in the cool of the morning, before we resumed our march, I tried to repeat the experiment, but there was no response whatever, while nearly a month later when we were back at this spot under conditions of cloud and occasional rain, there was no repetition of the concert, which of course my companions attributed quite seriously to the Jinns.

Our next stage was the well of Ziqirt, where by arrangement our scouts rejoined us to report that they had found no trace of Arabs anywhere in the neighbourhood of Shanna. The rumour of our coming had cleared the desert and we were left to fend for ourselves as best we might. For the moment the obvious thing to do was to proceed to Shanna, which we accordingly did, arriving there on February 20. This well had been dug by 'Ali Jahman, our chief guide, in 1929 or 1930, and it was from here that Mr. Thomas last year began his northward dash across the sands. He had then found the place comparatively thickly populated, but now there was not a soul to be seen and not a camel, though the pastures were as good as any we had found during the month we had taken to get here from Jabrin. My natural inclination was to continue our march southward in an endeavour to find the well of Thamut or

Qabr Hud in Manahil territory, the distance thence to Sulaiyil across the waterless desert being apparently about the same as from Shanna. My companions opposed such a plan on the ground that we might find ourselves in trouble if by any chance the Manahil (for whom of course we had letters) had turned nasty. To walk into a tribal concentration without introduction, they urged, would be tantamount to delivering their bread and butter on the doorstep. They would shoot first and apologize afterwards if necessary, and the consequences might be unpleasant for us. On the whole that idea had to be given up, and to make doubly sure my companions on the afternoon of our arrival at Shanna staged an alarm for my benefit. The look-out reported three men on camels in the distance. Immediately the alarm was sounded, the camels were driven in from the pastures, and all available hands manned the heights around us. It was all very comic, but the expression of my scepticism nearly produced a mutiny, which got as far as my being given a choice of two routes. We might go south-east in search of Hamad ibn Sultan and his Rashid friends, where we could count on a friendly reception, and there get guides to Dhufar. That seemed to me to involve traversing country already sufficiently explored by Mr. Thomas, and I had little hesitation in rejecting the suggestion, although it was tempting to investigate Mr. Thomas's tentative site for Wabar. However, as I have explained, I had had enough of Wabar, and that alternative was set aside. The other was to strike across to Sulaiyil from where we were. That was an essential part of my original plan, and I kept it up my sleeve without relinquishing my pressure for a southward march, as I should at least have liked to see where the sands came to an end against the mountains or steppe. To cut a long story short, we finally agreed on my companions' second alternative. The effect was magical. Our guards and look-outs were relaxed, and we settled down to a good day's rest at Shanna to prepare everything for the long waterless journey before us. Water-skins were regreased and botched, and the baggage-packs reorganized. I suggested sending our heavy stuff back by the water route through Ar Rimal, but they would not hear of it, and I confess to a little astonishment at the comparative light-heartedness with which they seemed to be facing a really serious proposition. In fact, Mr. Thomas had remarked in connection with Burton's plans for traversing the Rub' al Khali: "Assuming even such difficulties to have been overcome, the great problem would still have had to be faced, that of finding Arabs capable and willing to brave the arid wastes to the west of long. 51°." At such a juncture those were distinctly comforting words, but my companions seemed to be quite happy, and I had no need to worry further about the matter. I think they were partly influenced by the thought that they might get some oryx shooting and doubtless some of them had registered mental reservations in favour of abandoning the enterprise and striking back homeward in the event of the experiment proving too unpleasant; while there was also the consoling consideration that we should soon be back in civilization if we could push through the next ten days or so somehow. But it must be remembered to their credit that the route on which we were embarking had, as our guides assured us, never been attempted before, even by the raiding parties of the Badawin, which normally keep within reasonable reach of the wells in case of accident, thus fetching a circuit instead of going straight across as we proposed to do. One

of our guides had two or three times crossed to Sulaiyil from Maqainama and Bir Fadhil, keeping close to the northern edge of the desert, while the Murra tribesmen frequently in good seasons go out from Shanna, Naifa, and other wells for two or three days' journey into Hawaya and Shuwaikila to shoot oryx and even to graze their camels, on whose milk they live the while. Similarly, shooting parties from Sulaiyil are wont to penetrate from the west for three or four days into the desert as far as the edge of Abu Bahr. But all my inquiries have failed to produce any evidence of a direct side-to-side crossing. Yet we were now attempting it with the full paraphernalia of tents, heavy baggage, etc., besides some thirty-two skins of water. For such rashness we were to pay dearly, but from it we learned the secret of success.

I judged the distance to be about 350 miles in a straight line and thought we might do it in fifteen days with luck. Yet our guide said we should be across in eleven or twelve at the outside. And so on February 22 we started, nineteen men, thirty camels, and a dog. The first day we took very easily, as I with a few men made a considerable detour to visit all the wells west or south-west of Shanna, namely, Arfaja, Bir ibn Suwailim, Mamura, Zuwaira, and Turaiwa. Incidentally, all these wells lie in what is obviously a continuous valley bottom, which extends eastward or north-eastward of Shanna in a long line of exposed gypsum patches. I had tentatively suggested in a letter to the *Journal* last year that this depression, shown by Mr. Thomas's aneroid readings, might be the eastward continuation of the Wadi Dawasir channel. The line of wells and gypsum patches provided support for such a theory, and on the second day out I felt no further doubt about it. We came upon an immense deposit of fresh-water shells similar to those found 200 miles farther north and gave the nameless locality the name of Abu Muhairat, "the father of shells." For some distance westward along our course outcrops of the underlying gypsum were observed from time to time, some of them with small shows of shells; but slowly and surely the sand got the upper hand, and then it was but rarely that we had a glimpse of the firm ground beneath. The utmost depth of sand from the rock-bottom to the tops of dunes and ridges I judged to be about 150 to 200 feet in these parts, but when we reached the tract of Qa'amiyat the tumbled massif of sand-hills which we skirted seemed to rise to heights of perhaps 500 feet. Those were certainly the highest sands I saw, and my guides thought they were the highest in all the great desert, though I should think it quite likely that the peaks round Dhahiya may rise to 700 feet, as reported by Mr. Thomas. That must however be very near the possible limit for the piling up of such unstable masses, while I am provisionally of opinion that the loftiest sand-masses in the Rub' al Khali area will be found concentrated in its southern and south-eastern parts. The higher desert of the west would seem to carry lower dunes, possibly on account of their greater exposure to the action of the winds. At any rate, nothing that I saw after Qa'amiyat compares with that tract in the matter of sand-elevation.

Occasionally we saw recent tracks of oryx in these parts, but as we advanced westward the vast wilderness became more and more barren and desolate. For twenty years or so, said my guides, no rain had been reported from these parts and no Arabs had visited it. The withered shrubs, whose long writhing blackened roots lay exposed on the burning surface of the sands, proclaimed

the death agonies to which after a game struggle they had succumbed. Occasionally a still living bush of Hadh or Abal caused quite a sensation among the camels, but the lack of fresh fodder was beginning to make them thirsty, while their growing thirst rendered them incapable of browsing on the dead herbs. They mooned along disconsolate, and my people began to whisper among themselves ominously. We were gradually getting beyond the likely haunts of oryx, and even the raven knew that it was of no use looking for food here. Drought and famine stalked the land in an unholy alliance, and on the fourth night out, when we had covered just about 100 miles, there was talk in the camp of going back. It was our practice to send the baggage train on about 1 or 2 a.m. and ourselves to follow after dawn. On the fifth day at about noon we were somewhat taken aback to find, on topping a ridge, that the advance party was in camp with the tents pitched for the first time since our leaving Shanna. The very worst had happened. Some of the baggage camels had simply collapsed, and we found them actually in the tents against the risk of sunstroke. With only dates for our diet during the past five days we ourselves were very near starvation, and I felt weak enough physically to know exactly what my companions were suffering—not that they were at all backward in saying so. They began to murmur against me, demanding food and water. I was like Moses in the wilderness, but without his miraculous gifts. There was nothing for it but to go on, I said. Not at all, said my companions, there was nothing for it but to get back as soon as possible to the nearest water, and give up this fooling with life. We wrangled thus in that terrible desert, and I lost. The victory was celebrated by pouring out much of our precious water to the most sorely afflicted camels. The rest were given a more economical drink through the nose to cool their brains. And the men sat down to a midnight feast of rice, of which, hungry as I was, I refused to partake. At 1 a.m. the baggage train was started off eastward on the 130 miles retreat to Naifa. I tried to sleep, but the spectre of failure haunted me. At dawn we too started on the way homeward. I rejected every attempt at conversation on the part of my companions, and they began to wonder what would happen when we got back to Hasa. Early in the afternoon we came up with the baggage in camp, with the camels again under canvas. One of them had collapsed with fatigue and given birth prematurely to a calf, which was in process of being roasted on the ashes when we arrived. I was so hungry and exhausted that I ate of its flesh without any feeling of disgust, and I felt better. In due course we pushed on when the blazing sun had lost something of its force, and they begged me to march by night. I refused, and our water-supply was getting low. I had drunk no water for nearly two months and could afford to laugh at their concern. Next morning the guide's camel showed signs of distress. We had to halt, for it was about to become a mother. We all assisted at the midwifery. It was a ghastly affair, but the calf was born alive and immediately slaughtered in the name of the merciful God. We proceeded to eat it then and there, and again I ate my share, and over that meal we sealed a pact. If I agreed to press on with some night marching they would make another attempt on the waterless desert from Naifa, but the baggage animals would be sent home by the water route and we would travel light with all the water possible. I scarcely thought they would keep the pact, but it was my only chance of avoiding

failure. We pushed on, and on the fourth night of the retreat from Hawaya we arrived at Naifa. I drank many pints of its medicinal water, and for four days I underwent the cure, which was somewhat exhausting, to be sure, but otherwise not harmful—possibly, indeed, beneficial, as I certainly lost no weight as the result of my ninety days in the wilderness. To induce a more courageous outlook on affairs we killed a camel and lived right royally, but the main factor which made for ultimate success was a complete change in the weather. On March 2 I was awakened by drops of rain, and during the days that followed the storm clouds gathered about us with occasional light showers. The tempests tossed the sands about us and ever and anon swooped down on our hollow, uprooting the tents and covering our meat-dump with thick layers of sand. The temperature dropped, and all day long our scouts were up on the heights joyfully spying out the direction of the clouds and rain and lightning. The sands refused to sing any more, but raced along the ridges like black squadrons of Valkyries with banners streaming in the wind. Our preparations went on apace while the camels grazed, and I was gratified to find that now there were more volunteers for the dash across the desert than for home with the baggage. I was able however to get rid of some of the more troublesome spirits, including our chief guide, who had so badly let me down in the great crisis of our fortunes. And I took the precaution of sending back with the baggage all my maps and records up to date in case of accident.

On March 5 all was ready and the camels came in for a final drink. The baggage folk, returning to Riyadh, went off first, and at sunset we ourselves started—eleven men and the dog with fifteen camels carrying twenty-four skins of water and the dates and raw dried camel meat (not salted), which were to constitute our sole diet until we reached civilization. No water could be spared for cooking, so we carried no rice. The raw meat was pleasanter than it may sound, and certainly provided the energy we so badly needed, while I had annexed a few onions from the kitchen and also had a large tin of peppermints to suck on thirsty days. We camped the first night after only a few hours' marching near Adraj, and the next two days cloudy skies enabled us to keep going from dawn to sunset with only short halts for refreshment, while the grazing was fair. On the fourth day the clouds failed us, but we reached a point abreast of though far to the north of the point from which we had retreated in the tract called Hawaya. From this point on the pastures failed us and the camels had to make the best of very dry dead herbs. The fifth day the familiar conditions of heat, drought, and famine resumed their sway, while we passed from Hawaya into Shuwaikila and thence into a vast bare gravel plain called Sahma between it and the sand-ridges of 'Awariq. From the gravel we entered the flattish sands of Bani Ma'aridh, reaching the eastern edge of Abu Bahr early on the seventh day. At the previous day's midday halt we reckoned that we had reached the very heart of the Rub' al Khali, being then something like 200 miles from the nearest water in any direction. I imagine that such a situation can easily enough be paralleled from the Sahara or other deserts of the world, but certainly not in Arabia. Nevertheless I felt safe. There could be no question now of going back. The consequences would be the same in any direction should the camels break down, so we might just as well go forward, and there was no question of anything else. Four of the camels had shown

signs of strain that day, and we gave them two skins of our precious water between them to keep them going. The others from time to time had a kettle of water through the nose, and by now we knew that we had enough water to see us through if we did not break down. It was here that we came upon the recent tracks of a female camel and her calf lost in the desert, and, strange to relate, we afterwards heard that they had actually got home, being part of the booty carried off by the raiders from the woman already mentioned. They had apparently strayed from their captors during the night and been left to their fate. They had then wandered east into the heart of the desert, but instinct had led them thence north to their own folk in the Dahana. Abu Bahr is an immense gravel plain lying south of the Summan and between Bani Ma'aridh and Rumaila, about 50 miles wide and perhaps 150 miles long, thus forming a veritable sea of steppe in the midst of the great sands. Our guide had never been here before, though he had skirted this steppe far to the north. He had no idea of its width, but he told us to keep a look-out for high sand-dunes ahead marking the beginning of Rumaila, the southward continuation of the Dahana sand-strip. In all this vast expanse of Abu Bahr there was nothing but gravel, not a blade of dry grass, not a dry stick of any kind of which we might make a fire for tea or coffee—a perfect speed-track or aerodrome, but without a drop of water. And as we marched across it the sun blazed down on us mercilessly. At midday we ate dates dipped in butter. Our last drop of tea and coffee dated back to 5 a.m., and so far I had drunk not a drop of water since Naifa. I began to feel thirsty. The onions and peppermints made matters worse, and the guide tempted me with water. I resisted then, but an hour later I succumbed, and sat on the ground sipping that salt water as if it were nectar of the gods. And on we marched, driving the great thirsty beasts without mercy. Yet never a sign of the welcoming sands beyond. The sun went down and we drove on. Never have I seen Arabs all out as on that day, driving on furiously with but one thought in their minds—coffee! At 9.30 p.m. I said I would march no more. We halted for the night, and the coffeeless Arabs cursed me; yet we had marched for twenty-one hours that day almost without a respite. We had water and dates; what we really needed was sleep.

The storm-clouds gathered again about us as we slept, and next morning we found that we had camped within five minutes' march of a patch of dead bushes which would have given us coffee. We had now actually marched about twenty-seven hours without coffee or tea, which must be something like an Arabian record, while before we came to some possible pasture the camels had done forty-eight hours without a bite of any sort. That was a magnificent performance after two months of unremitting marching in the desert under pasture conditions as unfavourable as one could wish to see.

That forced march of March 11 was as decisive as critical. We had broken the back of the Rub' al Khali, which had done its utmost to break ours. Next day we saw far ahead the dark line of the Tuwaiq mountain, and we camped on the gravel plain of Jidda (or Hidba) after an easy day across the ridges of Rumaila and the undulating sand-plain of Al Qaunis. Near by to the southward lay the bushy line of the Wadi Dawasir channel, and all over the vast plain we could see the lines of vegetation which betrayed the freshets of Tuwaiq. And, what was more, animal life began to reappear, birds and

lizards and jerboas, such as we had not seen over 300 miles of the drought-stricken wilderness. A raven and a few small birds and one hare were indeed all we had seen (with an occasional lizard) in that dead land, though on the second day out we had again met a swallow! Everything else we saw was dead, an occasional oryx and perhaps a dozen of the white Rim gazelle, all dead of hunger where we found their horns and bones. A shattered ostrich egg completes the catalogue, excluding insects.

We still had some 60 or 70 miles to go, and we stepped out vigorously to bring the camels to water. On March 13 we travelled 50 miles, but the thunder-clouds made the conditions very different from what we had had in Abu Bahr. In fact, when we started at 2 a.m., I had to do the piloting by compass, as our guide was unable to keep a course with neither stars nor landmarks to help him. And I received quite an ovation when some time later a break in the clouds revealed Jupiter straight ahead of us, the planet which had indeed presided over my venture from beginning to end since the latter part of November, when it looked as if we would never get started and he seemed to mock me as I lay abed at Riyadh with the great interrogation mark of the Sickle at his side. And now, on our last day, he appeared without the query as if in recognition of our success, while as he sank beyond the horizon Regulus appeared for a moment without the rest of the Sickle, which remained clouded over. That was the full-stop at the end of the story. The clouds dropped to the horizon and above them the Bear and Raven with Spica and Arcturus formed a triumphal arch for us to march into until the sun rose behind us and blotted out the illuminations of our last night-march.

By that evening we had reached the large and luxuriant coppice of Farsha, which is the lowest part of the Dawasir channel that still receives flood-water from above. And next morning we had but a short march, though not without an alarm. Seven figures appeared stealthily from the Farsha bushes some way ahead of us and seemed to be trying to cut us off. In a moment rifles were unslung and loaded for action, when some one cried out that they seemed to be unarmed. Next minute there was relief and laughing. They were women! And soon we were exchanging greetings and news with a charming old lady and her pretty daughter, the former veiled and the latter sufficiently conscious of her beauty to be coyly careless. And that was our welcome back into civilization after fifty-three unrelieved days of our own company. Meanwhile Sulaiyil was killing the fatted calf for the prodigal returned after fourteen years by way of the land of the Jinn. And in due course we feasted to mark the end of a chapter in the course of which we had done little perhaps but prove that popular rumour lied not in asserting that the western part of the Rub' al Khali is waterless, uninhabited, and uninhabitable, as it must have been from the earliest beginnings of human time. In years gone by, measurable in millions, the Eocene ocean had thundered over these vast spaces against Jurassic cliffs; and, earlier still, some tens of millions of years before our time, Jurassic billows had rolled against the primeval core of Arabian granite. But puny man, with his paltry tens of thousands of years, had never before, so far as we know, traversed the floor of those ancient seas. And that is why we call it the Empty Quarter.

DISCUSSION

Before the paper the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: Twelve months ago, almost to a day, we heard an account of a journey across the Rub' al Khali from south to north. To-night we are to hear an account of another, from north to south, from Hufuf to Jabrin, on to Shanna in the south, almost to the Hadhramaut, and then from east to west, to Sulaiyil. These journeys, both accomplished by Fellows and Gold Medallists of this Society, are complementary. They add names to a list, and a famous list, of travellers in Arabia whom we have been proud to include in our Fellowship and whose lectures and papers we have listened to and read in the *Journal* with great profit: Burton, Doughty, Gertrude Bell, Wavell, to mention only four of them.

It is agreeable to know that in Mr. Philby's journey which he is going to describe to-night he had with him a copy of the *Journal* for September 1931, which contained Mr. Bertram Thomas's description of his journey across the Rub' al Khali and his map, which Mr. Philby tells me he was glad to have with him and to be able to make use of.

Mr. Philby was captain of the school at Westminster, that school where Sir Clements Markham spent the years of his boyhood and of which he was so intensely proud. From there Mr. Philby went to Cambridge and obtained a First Class in Modern Languages. He then went to India in the Civil Service, and his services in India, in 'Iraq, and in Transjordan were many and varied. But it is Arabia which claims his interests. It is not the first nor the second, but the fourth time that he has lectured to us on his travels and journeys in Arabia. We have both listened to and read the descriptions of his journeys, and we may say, without any exaggeration, that his knowledge of that country is unsurpassed. We shall listen to-night to the account of his recent journey with great interest; and I think you will realize, Mr. Philby, that the size of this audience is an indication of the great expectation with which we look forward to your lecture.

Mr. Philby then read the paper printed above, and a discussion followed.

The PRESIDENT: His Excellency Hafiz Wahba, Minister of the Hejaz and Nejd, is with us, and I ask him to come on to the platform and address the meeting. He prefers to speak in his own tongue, but his speech will afterwards be translated to you by his Secretary.

H.E. SHEIKH HAFIZ WAHBA, Envoy Extraordinary and Minister Plenipotentiary of His Majesty the King of the Hejaz and Nejd to the Court of St. James, said a few words in Arabic which were translated by Monsieur Mahmood Riyad Zada, the First Secretary of the Hejaz and Nejd Legation in London, as follows:

Mr. Philby, or our brother Abdulla Philby, is a great and old friend of mine and of His Majesty King 'Abdul 'Aziz ibn Sa'ud. His love of exploration is very well known to all. Mr. Philby has always cherished the idea of crossing the Rub' al Khali and has often approached the King to grant him permission to do so. It was with great pleasure that I learned that His Majesty had allowed Mr. Philby to undertake the journey, and had graciously organized and equipped a special expedition for the purpose, and it is with great pleasure that we have all heard of the success of the expedition. I take this opportunity to congratulate Mr. Philby on his success and to express to him the pleasure which all Arabs feel at the accomplishment of this expedition which, of course, is the first scientific expedition of His Majesty's Government of the Hejaz and Nejd in a part of His Majesty's territory. It is also with pleasure that I announce to you to-night that the scientific collection Mr. Philby has been able to make will be presented by His Majesty King 'Abdul 'Aziz to the British Museum.

In conclusion, I once more congratulate Mr. Philby on his success and thank the Royal Geographical Society for inviting me here to-night and giving me the pleasure of listening to such an interesting lecture.

Mr. BERTRAM THOMAS: You have listened to a modest—I think a too modest—account of a magnificent journey. Mr. Philby has likened us two to Jacob and Esau. I am Jacob. I know I ought to feel heartily ashamed of myself, but what I actually feel is pride in standing to-night on this platform and paying my tribute to this great journey of Mr. Philby's. It is a special privilege, because it was Mr. Philby who, ten years ago and more, first infected me with some of his enthusiasm for exploration in Arabia.

The point that interested me as much as anything was his identification of what may be a volcano, perhaps—I do not know what it is !—at any rate his identification of some natural phenomenon that he found in the middle of the sands—with Ubar. Mr. Philby said he had two guesses at Ubar. I only had one; and if you have two guesses at anything one at least is bound to be wrong. On the other hand, I do not claim that on that account my Ubar is likely to be more accurate than his.

I have during the past fortnight or three weeks, as a result of Mr. Philby's own suggestion to me long ago, been studying Arabian authorities. At the time I made my journey I actually did not identify Ubar with Wabar; but you will remember that I was told by the Arabs of those parts that a buried city in the sands of Shu'ait was known to them as Ubar, and they actually pointed out to me deeply graven and quite abnormally extensive camel tracks in the steppe leading to it, or rather leading into what is now the southern bulwark of the sands. Well, that site of the traditional buried city is about 150 miles from the spot now suggested by Mr. Philby as Ubar. Still, I do not think that need worry us. You see, the mediaeval Arabian authorities have come to our rescue. Yakut was writing six hundred years ago, and I suppose he is the most reputable writer of those times. He it was who collected all the references of earlier writers about Ubar, and what his book says—*inter alia*—about Ubar is that it is a country that is 300 *farsakhs* long and 300 *farsakhs* wide. A *farsakh*, I might say, is the same as a *parasang* in Persian, and that is the distance a man can walk in an hour; that is to say, a *farsakh* is about 3 miles. So that Ubar, according to Yakut, is a country 900 miles long and 900 miles wide. That is quite large enough to include both Mr. Philby's Ubar and mine! And the same writer goes on to say that Ubar lay between the Yemen, the Hadhramaut, and the Mahra Yabrin, and that it was a land richly afforested, with copious water, with perennial streams, and thickly inhabited; in short, a land flowing with milk and honey, as we should say.

Talking of honey reminds me of a story. I am sorry if I am detaining you at this late hour, but I really must tell you this Arabian story. It is about a hunter. This hunter went after wild animals, as hunters do, and found himself up in some mountains where, in a grotto, he found a hole in the rock; and the hole was full of bees' honey, so he filled up his water-skin with honey and set off to the nearest town to sell it, followed by his favourite hound, a dog very like the one you have seen on the screen to-night. When he reached the outskirts of the town he met a saddler, and thinking the saddler might be a likely purchaser, told him about the honey. Well, the saddler said he would like to buy it. So the hunter proceeded to pour out the honey into a receptacle that the saddler had, and in doing so he spilt some of the honey on to the ground. Immediately all the flies that were flying around, and there are lots of flies in Arabia, came flocking to the honey. As they did so a bird passed over and, seeing a multitude of flies, swooped down. Well, the saddler had a cat, and the cat, seeing the bird, leapt upon it and devoured it. At that point the hunter's dog, which detested

cats, sprang upon the saddler's cat and killed it. Of course that made the saddler very angry, and so he leapt upon the hunter and slew him. Now the hunter and the saddler belonged to two different tribes, and when these tribes heard of what had happened they each fell upon the other, and so great was the havoc that no man was left to tell the end—the end was known only to Allah, the Almighty. The moral of that story is that I quite agree with Mr. Philby that neither of us ought to spill any honey on the site of Wabar. Positive evidence of ancient habitations would appear to be slighter on the northern site than on the southern one.

Before sitting down I would like to pay a very sincere tribute to what I consider for a European an unprecedented march in Arabia. I refer to that section of Mr. Philby's journey west of the 51st line of longitude. I think that part of his journey particularly admirable. Nobody who has not been to Arabia can realize the tremendous physical difficulties that he had to face and surmount, and the firmness, knowledge, and resolution necessary to induce his Arabs to go with him. It is perfectly true that in winter, after rains, the Bait Imani and the Rashid, and some of the semi-steppe tribes, penetrate into these western lands following pastures, but that is altogether different from what Mr. Philby did. He went through that absolutely well-less area, 350 miles wide, which was almost pastureless at the time, with camels that were laden, with camels that were tired, with camels doing forced marches. That to any one who knows anything about the technical side of Arabian exploration is, in my opinion, an amazing thing to do. I very sincerely congratulate Mr. Philby. There are other points that I had proposed to refer to, but the hour is late. I am sure I am voicing the feeling of everybody here when I say how grateful we are to Mr. Philby for his most thrilling story and for telling us about what is indeed a historic journey.

The PRESIDENT: The exhibits on the table and others are being studied by Dr. Spencer. Dr. Spencer told me this afternoon that he could write a book about them. I told him that if he would come to this meeting and speak for five minutes we should be very glad to hear what he had to say. Dr. Spencer.

Dr. L. J. SPENCER: During his wonderful journey across the Arabian desert Mr. Philby collected a large quantity of valuable material of all kinds, the value of which is greatly enhanced by the precise information of locality which accompanies each specimen. All this material has been generously presented to the British Museum by H.M. the King of the Hejaz. While this unique collection includes a certain amount of archaeological and ethnographical material, the bulk pertains to natural history, and the various objects are now being distributed among the several departments of the Natural History Museum at South Kensington. The large series of rock specimens for preservation in the Mineral Department includes many curious and wind-worn stones. Of greatest interest is the material collected by Mr. Philby on the site of the supposed ancient city of Wabar, in the Rub' al Khali. Here, around two craters, he found large quantities of slaggy and cindery material, which at first suggested a volcano; also a lump of iron weighing 25 lb. together with a few smaller pieces of iron and fragments of iron rust. A preliminary examination of the iron shows that it contains nickel, and a polished and etched section reveals a structure (Widmanstätten figures) peculiar to meteoric iron. The slaggy and cindery material is a pumice-like glass, but it is not a volcanic glass. It is a silica-glass, produced no doubt by the fusion of the quartz sand. These pieces of silica-glass are often complete individuals or "bombs," consisting inside of a very cellular white material and covered with a thin lustrous skin of black glass free from bubbles. Light "black pearls" of this description were collected in considerable numbers. Some of them show tiny beads of the black silica-glass welded on the surface.

Since quartz fuses at about 1670° C., a very high temperature is here indicated. This association of silica-glass with meteoric iron around the craters can be explained only by the impact of a large meteorite.

Very little is yet known about meteorite craters as topographical features on the Earth's surface. They have been compared with the craters of the moon, but they are of course on a much smaller scale. Until quite recently, the only known example was the Meteor Crater in Arizona, the origin of which has been the subject of much controversy. More conclusive evidence was collected last year around a group of craters near Henbury, 50 miles south of the MacDonnell Ranges in Central Australia. Other supposed meteorite craters have been recently described from Ector County in Texas, from the island of Oesel in Estonia, from near the Stony Tunguska river in central Siberia, and at Lake Bosumtwi in Ashanti (*Geogr. J.*, Sept. 1931, vol. 78, p. 270). Silica-glass in association with meteoric iron has been found around the craters in Arizona and Central Australia; but at Wabar there is a more abundant and varied development of this material—possibly because of the sandy desert. Mr. Philby's collection (from localities other than Wabar) also includes another form of silica-glass. These specimens have the shape of tubes and the thickness of a pencil, with a smooth glazed interior and a rough sandy exterior. These are fulgurites or "lightning tubes," and were formed by lightning striking the sand-dunes.

What exactly would happen when a very large meteorite comes into collision with the Earth's surface would be difficult to say—any nearby traveller would not return to tell the tale. An iron mass of a million, or even a thousand, tons entering the Earth's atmosphere with a velocity of 45 miles per second possesses an enormous momentum, and when suddenly checked the kinetic energy of motion must be immediately converted into heat at a very localized spot. All moisture in the surrounding rocks will be suddenly turned into steam, both silica and iron will be vaporized, and there would be a tremendous "back-fire," blowing out all the fragmentary material and what remains of the meteorite itself to form the rim of the crater. Fused silica full of steam bubbles would be spurted out. The only explanation that can be offered to account for the smooth lustrous skin of the "black pearls" is that this shower of molten silica passed through an atmosphere of silica and iron vapour.

The PRESIDENT: May I, Mr. Philby, first of all express to you the great appreciation of this Society and audience on your having reserved for us the first account of your journey and of the discoveries you made on that occasion.

The hour is somewhat late, and all I have to do in giving our thanks to Mr. Philby, which is a very pleasant and also very sincere task, is to say that Mr. Philby tells me that he has brought home material enough for many volumes—and I am not surprised—on the subjects akin to that which we profess in this building: the geology, the anthropology (which he has not even mentioned), the archaeology. He showed me one or two of the flint instruments which he has brought back, one an arrow-head in red flint which is one of the most beautiful things of that nature that you could possibly imagine—I will not say that I have ever seen, for it is not a matter of which I have expert knowledge. As to the exhibits here, am I treading on very dangerous ground when I say there may be considerable discussion as to whether they are all natural products or phenomena, or whether some of the pieces may perhaps be decayed and rusted iron, the product of man's hands? These are matters which, no doubt, those well versed in them will investigate; I can quite imagine that Mr. Thomas and Mr. Philby, although they are not prepared to spill any honey over it, may have a considerable discussion as to the possibilities of Wabar being Ubar.

There is one part of Mr. Philby's cavalcade which I think we ought to give

some credit to—he does himself—and that is his camels. Not lovable animals, they say; but they seem to combine those qualities which I and my brother officers here thought were accredited to those of our profession, that they are able to work and grumble at the same time. As to the journeys themselves we can speak with some confidence in this hall, for we have heard descriptions of many. I beg you to realize, Mr. Philby, that we feel the most sincere admiration for the resolution you displayed in going on in face of very considerable difficulties, and to accept our gratitude for your work and for the way in which you have described it this evening.

EARLY MAPS OF GREAT BRITAIN: *Three papers read at the Afternoon Meeting of the Society on 14 November 1932*

I. THE MATTHEW PARIS MAPS

J. B. MITCHELL

THE group of maps produced at St. Albans in the thirteenth century and associated with the name of Matthew Paris has peculiar interest first for the variety of types represented, and secondly as the work of what may probably be regarded as the earliest English school of cartography. This important group of maps has already received some attention. The question of the autograph handwriting of Matthew Paris has been much discussed by paleographers, and the maps have received incidental mention in this connection. Sir F. Madden[1] accepted them as drawn by Paris himself; Sir T. Duffus Hardy[2] rejected this view and attributed them to the rubricator of the scriptorium; Dr. M. R. James, who pays particular attention to the drawings of Matthew Paris, does not pronounce upon the authorship of the maps; all are concerned solely with the paleographical problem. Konrad Miller[3] gives them fuller treatment; he accepts Sir F. Madden's ruling, and since each map has individual peculiarities, concludes that each is an independent production of Paris himself. Professor Beazley[4] adopts this view; but Dr. J. P. Gilson in his introduction to the excellent facsimiles[5] of the maps of Britain stated that they are "possibly by one hand and possibly but not certainly by the hand of Matthew Paris."

A detailed study of the cartography and geography of the maps has not been made, and such has been undertaken for its intrinsic interest and also since it reveals the character of the sources used, the method of compilation, and the interests of the mapmaker; in fact, only in the light of these can the geographical conceptions be fully appreciated. The study also throws light on the relationship of the various versions of one design, and when completed may also help in the solution of the question of the authorship, or rather draughtsmanship, of the maps. This paper will be limited to a consideration of the four versions of the map of Britain. The subject forms a thesis which I hope to publish later; it is extremely difficult to summarize a study the interest of which lies largely in the elucidation of detail, and merely an abstract of the conclusions reached will here be given, indicating by a few isolated examples the character of the detail on which these conclusions are based.

The Maps

The maps are found in St. Albans manuscripts of the thirteenth century, the most finished and elaborate of the four being prefaced to the 'Abbreviato

[1]Sir F. Madden, Introduction, Vol. III, M. Paris, 'Historia Anglorum,' Rolls Series, 1866.

[2]Sir T. Duffus Hardy, Introduction, Vol. III, 'Descriptive Catalogue of Materials,' Rolls Series, 1871.

[3]Konrad Miller, 'Mappaemundi,' Heft III, 1895–8.

[4]C. R. Beazley, 'Dawn of Modern Geography,' vol. ii, Murray, 1901.

[5]Four Maps of Britain designed by M. Paris, British Museum, 1928.

chronicorum Angliae' in the Cotton MS. Claudius D VI. Another version, in which unfortunately the lower half of the page is missing, is found in MS. 16 of the Corpus Christi College Library, Cambridge, which contains the second volume of Paris's 'Chronica majora.' A very similar map, rougher but complete, is found in the Cotton MS. Julius D VII, a manuscript containing thirty-six items, all St. Albans work, but none of them the writings of Paris. The fourth map is directly associated with Paris's work, since it is bound up with the only complete copy of his 'Historia Anglorum,' in the Royal MS. 14.C.VII. This map is a more unfinished, uncoloured version, similar to the others in the essential features of the English outline but differing markedly in the delineation of Scotland.

The Cartography of the Maps

The execution of the maps shows an understanding of the principles of cartographic art. There is a simple but effective use of conventional signs, and though these are largely pictorial a further development is shown, for example, in the skilful use of blue colour introduced into the lines and lettering in the Fenland to indicate its marshy character. A rough scale is suggested by means of legends, a new departure for mediaeval cartographers, though a legend of the Royal map confesses that true proportion has been abandoned in order to fit the paper. The Julius and Claudius maps provide a relative scale by reference in marginal legends to opposite portions of the continent, giving England an exaggerated length, since *Haec pars respicit Holladia* is written off the Yorkshire coast and *Haec pars respicit Normannia* off the coast of Suffolk. This method of delimiting Britain is the traditional one quoted by most of the English chroniclers from Pliny or Orosius. The sequence on the Claudius map corresponds closely with that given by Gervase of Canterbury in his 'Mappaemundi.' The Corpus Christi map has an extremely interesting scale legend in that it differs from the usual form. It runs "Anglia habet in longitudine DCCC. [miliaria Pen]esfeld qui locus est ultra montem Sci Michael in Cornubia [usque ad Ca]tenes. Latitudine vero CCC miliaria de Sci David [usque ad] Doveram."[1] This expanded form, naming the terminals, is new and the original authorship obscure. Ranulph Higden[2] cites it and attributes it to Alfridus, whom the editors of the 'Polychronicon' in the Rolls Series identify as Alfred of Beverley, though acknowledging that the passage cannot be found in his work. It is possible that Ailred of Rievaulx is intended, for the earliest occurrence of the passage is in the thirteenth-century Royal MS. 13.C.V., where, though it begins a new folio, it has no introductory rubric and follows without a break and in the same handwriting the history of Ailred of Rievaulx. The apparent continuity is a mere accident of binding, but this or a similar MS. used by Higden may have given rise to the error. This manuscript, which on other grounds is thought to have been used by Paris, is probably the direct source of the map legend, since the wording agrees almost identically.

The diagrammatic character of mediaeval maps is also exemplified in this group. Distortion for a specific purpose was considered legitimate and does

[1] Words and letters in square brackets are wanting on the map.
[2] Ranulph Higden, 'Polychronicon,' vol. ii, p. 10, Rolls Series.

not necessarily denote ignorance or misconception of the area. The position of Dover, placed centrally at the bottom of the map, and the consequent distortion of South-East England is, for example, due to the desire to emphasize the importance of the northern route, the itinerary on which the map is based.

The Geography of the Maps

A detailed examination of the geography, the legends, and the names of the maps leads to the conclusion that the conceptions shown are in accordance with the postulate that they were built up round the itinerary, Dover to Berwick, using information derived from two sources. First, the influence is apparent of the stereotyped geographical descriptions with which Henry of Huntingdon, Ralph Diceto, Roger of Hovedon, and many others prefaced their chronicles, descriptions which were derived, barely modified, from Pliny and the Roman geographers. Secondly, knowledge derived at first hand or obtained from contemporary travellers is largely used. It is possible to see in the details the utilization of both these sources, and the mistakes which occur are those which would be very natural to a St. Albans monk attempting to visualize such material. In no case does it appear necessary to postulate a genetic connection between the St. Albans maps and the Britain of the map designs of Ptolemy, the portolan charts, or contemporary mappaemundi. Numerous examples might be given of the character of the sources of the detail and of the manner of compilation, but only a few typical ones may be referred to in this paper (see Plates 1–4).

(*a*) *The Itinerary*.—The road from Dover to Berwick forms the most important feature of the maps. An interesting comparison can be made between the Roman roads, the routes of the St. Albans map, the northern route of the Gough map, and similar routes of Leland's and Stow's itineraries. The map shows two Roman roads to the north (St. Albans map also indicates the easterly route) and two major deviations of the mediaeval and early modern routes from the Roman roads are to be marked; the western Roman road proceeds from Newark to Doncaster *via* Lincoln, while the rest follow a direct line between the two, and on the easterly route, London to York, the mediaeval roads proceed from Peterborough to Lincoln *via* Stamford and Grantham, while the Roman road utilizes the higher ground to the east of these towns. A deviation peculiar to the St. Albans route to include Belvoir, a cell of St. Albans, illustrates the local interest of the cartographer. The source of the information here embodied is certainly first-hand knowledge supplemented by travellers' descriptions easily available at St. Albans, a point on the route, and possibly originally used to produce a simple pictorial itinerary.

(*b*) *The Geography of Northern Scotland*.—The geography of northern Scotland is again in accordance with the information available concerning the region and does not appear to necessitate the postulate that there is marked easterly deflection due to either the influence of Ptolemy or to the necessity of fitting in the detail to the curved edge of a circular mappaemundi. Remembering that while the eastern area of Scotland was probably fairly well known, the area beyond Glenmore was entirely unimportant, I suggest that the narrow strip of land to the north-west of the water feature is a diagrammatic repre-

sentation of the north-west Highlands. Its small size may be due to a desire to conform to a traditional circular outline in this area and not to complete ignorance of its true dimensions. The water feature, blue, continuous from sea to sea, and variable in width, correlates very well in character and position with Glenmore occupied by Loch Ness and Loch Lochy and their attendant streams. The area to the east of this represents then the northern coast of Nairn, Moray, and Banff; the position on it of Aberdeen and Arbroath, both important monastic centres and thus probably of approximately known position, and a legend beneath "Suthnelande" on the Julius map which runs "situs frigidissimus extendens versus boream" suggests that the far North is not intended.

(*c*) *The North-West of England.*—On the Corpus Christi and Julius maps the river of the area is, from the position of Chester and Carlisle, to be identified as the Dee, and thus the southern arm of the sea inlet as Lancashire Bay and the Dee estuary, the northern as the Solway. On the Claudius map the position of Carlisle and the Roman wall shows that the river is here identified as the Eden; therefore the whole sea inlet represents the Solway, the southern arm the Eden estuary, the northern one that of the Esk, thus leading to the complete omission of South Cumberland and Lancashire. This is an excellent example of the manner of compilation and its difficulties, representing the attempt to fit into an older map form new and detailed information of the Solway area, probably obtained at second hand and therefore not visualized in perspective, which leads to the failure to realize the separate identities of the Dee and the Eden, a mistake facilitated by their approximately similar courses. Similar confusion of descriptions leads to the amalgamation of the Exe and the Dart, and the Gloucestershire and Hampshire Avons.

(*d*) *The Clyde River and Firth of Clyde.*—Failure to realize the identity of two descriptions, emphasizing different aspects of the same feature, also occurs. The relationship between the Firth of Clyde and the river has not been grasped, resulting in the reduplication of the former. The writings of Tacitus and Bede have fixed the position of the Firth of Clyde in its relationship to the Firth of Forth, while travellers' descriptions of the Clyde river, probably relating chiefly to its upper reaches, fixed its position far to the south of the Firth. The position of Dumbarton illustrates the confusion: the Claudius map places it on the Firth, the Corpus Christi on the river. On the Claudius map the Clyde appears in triplicate; a large river flowing into the Solway, apparently in the position of the Esk, bears the legend "Fluvius faciens Cludesdale," while the river named the Clyde in the other maps is still retained. This may be deliberate, the lower course of the Esk being regarded as continuous with the upper course of the Clyde; but since the name Clud is to be seen erased on the Dee-Eden river, its appearance here may be a copyist's error: in rectifying the original mistake the legend was written along the next river to the north instead of the next but one.

(*e*) *The Roman Walls.*—The representation of the Roman walls utilizes Bede's description, which however the maps show to be only partially understood by the thirteenth century. The Corpus Christi map shows Hadrian's Wall in an almost correct position, and to the north a tentative suggestion of the Antonine Wall but complete ignorance of its true position. The Julius

map shows one wall, an addition in a later hand, from Tyne to Solway; the position indicates that Hadrian's Wall is intended, though the legend runs "murus dividens scotos et pictos," showing confusion with the Antonine. On the Claudius map, owing to the identification of the Dee with the Eden, Hadrian's Wall is drawn south of its position on the other maps, the wall in its usual position is retained as the Antonine Wall and the "murus scotorum" of the Corpus Christi is correctly interpreted as a river—the Esk. The Royal map shows Hadrian's Wall roughly indicated as extending from the Solway to a similar indentation on the east coast. The creation of this eastern inlet and the existence of the Tweed bays in the other maps may be the result of the application of Bede's description of the Antonine Wall as running between two arms of the sea to the much better known southern feature. Similar bays of the early portolans and the complete severance of Scotland from England along the Tyne–Solway line of the later portolans may be ascribed to the same cause. Ranulph Higden,[1] discussing the position of Alcluith (Dumbarton), clearly shows complete ignorance of the northern wall and applies the description of its situation to Hadrian's Wall.

(*f*) *The Legends*.—The legends show a similar utilization of written sources and contemporary information. The descriptions of Scotland, for instance, probably have their source in the tales of a traveller such as the one "lately returned from a far distant part of Scotland where he had undertaken a long and toilsome journey." The Welsh legends appear to be adapted from writings of Gerald of Wales, while those describing the marvels of the Peak District and Bath have Ralph Diceto as a source.

(*g*) *The Names*.—Two hundred and fifty-two names appear on the maps, and I have been able to establish the identity of the few which the British Museum publication listed as unknown.

Abomine, referred to as Bomine by Gervase of Canterbury[2] and Roger of Hovedon,[3] is Bodmin, where a Benedictine monastery was established in A.D. 905. Mai, marked as an island in the Moray Firth region, should in spite of its location be identified with the island of May in the Firth of Forth; Gervase (p. 442) mentions it in his list of Fifeshire foundations, and Dugdale gives 1121 as the date of its foundation as a cell of St. Mary's Reading. The cartographer appears to have been familiar with the cell, though he connects it with the Moray Firth, a region which had other ecclesiastical associations. Goseford, a name given only on the Julius map, was an anchorage of the Deben river of marked importance at this period, as is witnessed by the numerous occurrences of the name in the Calendar and Patent Rolls[4] of the time. The British Museum list identifies "Klif" as Cleeve, Gloucestershire, but the close proximity of "Klif" to "Aust" strongly suggests the two are meant to be read in conjunction. The form Austreclive for Aust occurs in the Domesday Survey, while Austcliff is still applied to the prominent cliff at the eastern terminus of the "Old Crossing" of the Severn. The river marked on the Royal map and named "Lou" is undoubtedly the Aln; the

[1] Ranulph Higden, 'Polychronicon,' vol. ii, p. 67, Rolls Series.
[2] Gervase of Canterbury, 'Mappaemundi,' p. 424, vol. ii, Rolls Series.
[3] Roger of Hovedon, Rolls Series.
[4] Cf. Cal. Pat. Rolls, 19 H. III ; Cal. Close Rolls, 25, Bd. I.

form may be a corruption of either the Roman or modern name, while its position as the only considerable river between the Coquet and the Tweed makes identification certain.

A detailed analysis of the names has been made in order to determine the principles of selection; they may be divided according to their dominant interest into five classes: cathedrals and monasteries 81, castles 41, ports 33, route towns 11, regional and topographical names 86.

The interests of a monk and the specialized interests of a Benedictine monk of St. Albans is primarily and clearly revealed. Of a total of 166 place-names, 147 are monasteries, and of these 147, 68 are Benedictine; of 12 foundations too small to appear in Lane Poole's map of ecclesiastical houses of the thirteenth century 10 are Benedictine and 5 cells of St. Albans. Another point of interest is that some places owe their inclusion entirely to their importance as crossing places of rivers on the main routes: Queensferry, Earlsferry, Boroughbridge, Northallerton, Aust, Cricklade, and Ilchester are all important for this reason. The ports are particularly numerous on the Julius map, but all are later additions and have probably been inserted from an official port list, such as is to be found in contemporary Calendar and Patent Rolls, which include all the port names found on the map.

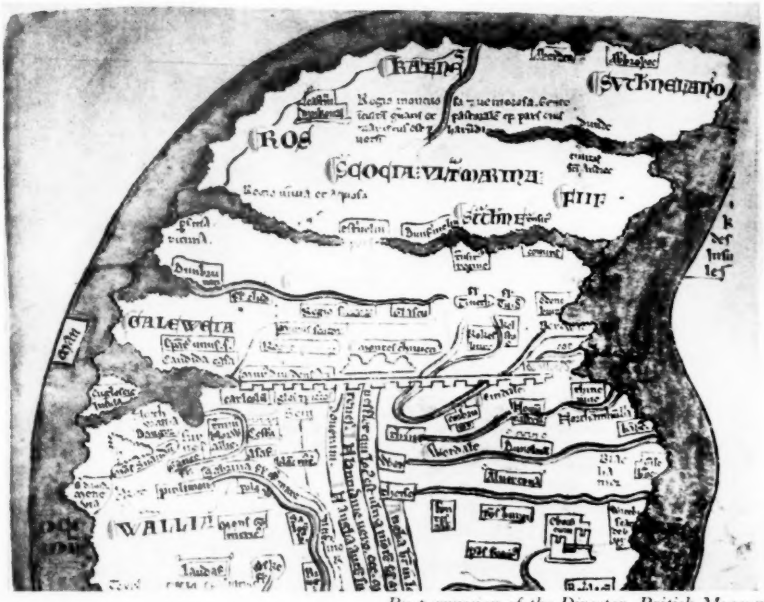
The Relationship between the Four Maps

Detailed examination of the similarities and differences between the four maps leads to the conclusion that they are copies of different immediate originals linked by descent from a common ancestral form.

The postulate that they are independent productions is untenable, since each map shows distinct signs of copying. The close similarity between various pairs on points of cartographical detail, just such points on which independent productions by one cartographer illustrating the same conceptions would be most likely to differ, suggests copying from a common map source. This similarity is particularly striking between the Julius and Corpus Christi maps, in which the outline common to both shows only variations due to freehand drawing; the spacing and spelling of the regional names and the arrangement of the towns of the itinerary are identical. The appearance of the same feature in the Claudius map as a river, in the Corpus Christi as a wall, can only be explained if the source is an indistinct feature on a map original, for no description of a river, however garbled, could lead to the visualization of a wall.

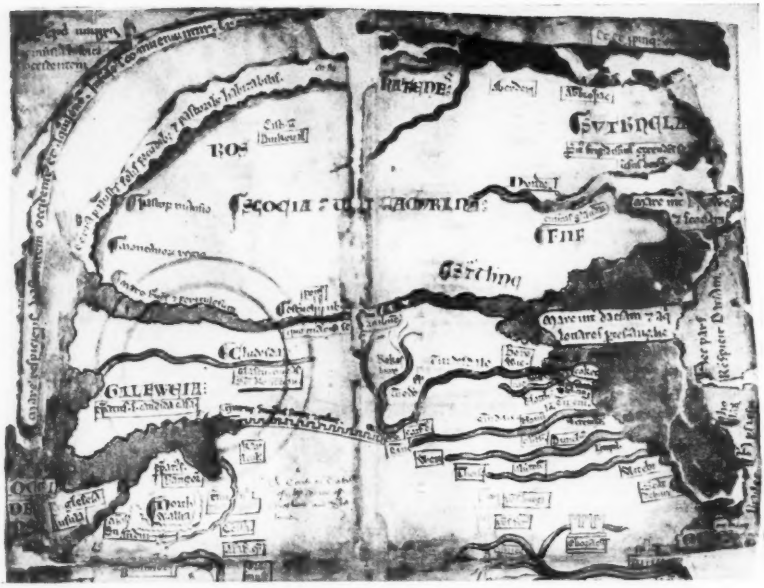
The assumption that the maps are copies of one original also fails to satisfy examination. The similarities of cartographical detail points to more than one source map, while the differences in knowledge and interpretation can only be explained on this assumption. The differences often exemplify an alternative, not merely a selective choice, and show differing information and interpretations of widely separated regions. Differences in geographical conceptions may result from different interpretations of the detail of the original by different brains or by the same brain at different times. The differences in these maps point to the former conclusion, since in some cases, *e.g.* the Yorkshire detail of the Royal map, a conception which can only result from absolute knowledge is not retained in later maps, and the sum total of the differences

Northern part of the Claudius Map

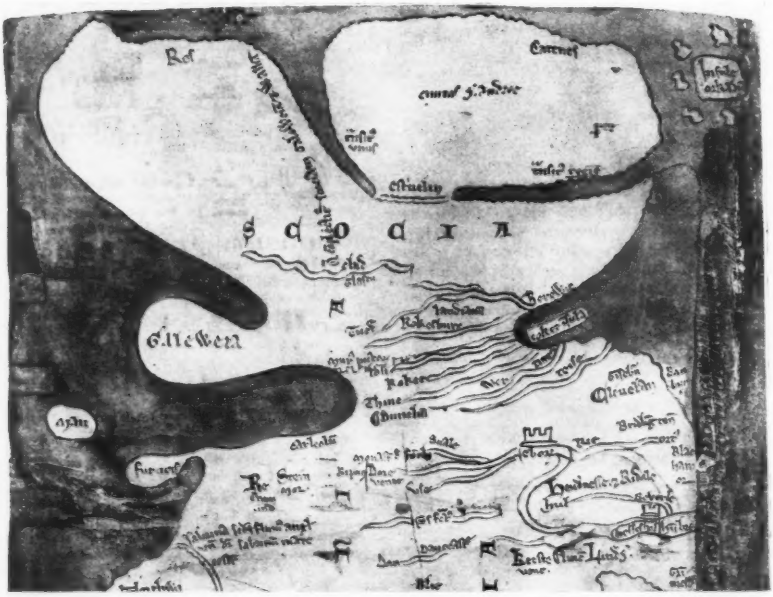


By permission of the Director, British Museum

Northern part of the Corpus Christi Map



Northern part of the Julius Map

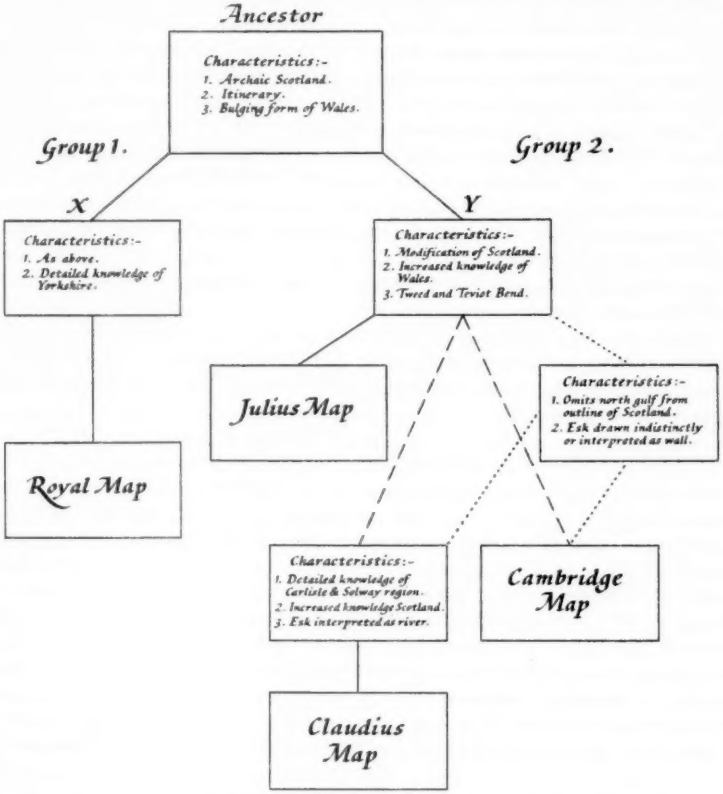


By permission of the Director, British Museum

Northern part of the Royal Map

and their distribution, if due to variant knowledge of one brain, would point to a lapse of time between the execution of the maps not otherwise indicated.

The case for different immediate originals is shown diagrammatically in the accompanying figure. A satisfactory relationship must allow for the general similarity of the four; the marked differences between the Royal and



The Relationship of the Four Maps

(N.B.—Two arrangements are suggested in Group II. If the maps are the work of one scribe, the Claudius and Cambridge are related to Y as shown by the dotted lines; if the work of two scribes, the relationship is as shown by the broken lines.)

the other three; the links between the Royal and the Julius; the closest cartographical affinities within the group between the Julius and the Corpus Christi; and the similarities and differences in both cartographical detail and geographical conceptions between the Corpus Christi and the Claudius.

The descendants of the common ancestor fall into two groups: Group I containing the immediate original of the Royal map on which appears the

detailed Yorkshire knowledge, possibly on other grounds the contribution of a monk of Beverley, and the Royal map itself. Group II contains a copy of the ancestor modifying Scotland, and the other three maps are regarded as descendants of this, thus accounting for their general similarity when contrasted with the Royal. If the extant maps are regarded as the work of one scribe, then the Julius is a direct copy of this map, the Corpus Christi a copy through one intermediary form, the Claudius through two intermediaries, thus explaining their progressive variation from the Royal. If, as the character of the cartographical execution of the maps also suggests, the maps are the work of two scribes, one responsible for the Royal and the Julius versions, the other for the Corpus Christi and the Claudius, then the Julius and the Corpus Christi may be regarded as direct copies from the same original and the Claudius a copy through one intermediary. The links between the Julius and the Royal can now be explained more satisfactorily as due to the identity of the copyist, while the close affinities between the Julius and the Corpus Christi may be regarded as due to the fact that both are copies of the same original, the differences as due to variation in the interpretation of the original of different scribes.

In the previous grouping the Julius bore the same relationship to the Corpus Christi as the Corpus Christi to the Claudius, while the maps show a closer relationship between the former pair than the latter. In this grouping that flaw is removed.

The maps of Britain reveal clearly the character of the geographical outlook of the thirteenth century, the methods of the map-maker and the difficulties with which he was faced. The maps are approximately contemporary in date, and though possibly by one hand, the style and the relationship of the versions are more easily explained if two cartographers are postulated. The question whether either of these hands may be regarded as that of Matthew Paris is from the point of view of the palaeographers undecided. Detailed study of the maps suggests agreement with Sir T. Duffus Hardy that they are not in Paris's autograph; they all show signs of conservative copying more suggestive of the work of a humbler member of the scriptorium. The study of the rest of the cartographical material of this scriptorium may throw further light on the question of draughtsmanship, but for the present it must remain an open one.

II. THE GOUGH MAP

R. A. PELHAM

Largely as a result, no doubt, of the popularity which the Matthew Paris maps have enjoyed on account of their comparative antiquity, the Gough Map of Britain, preserved in the Bodleian to which it was bequeathed by Richard Gough in 1799, has not hitherto received the attention which it undoubtedly deserves. As a record of topographical conditions in this country during the Middle Ages it is of far greater value than any surviving map of the period; although but a few decades later in date than those drawn up by the monk of St. Albans, it reveals a general accuracy and wealth of detail compared

with which the earlier maps appear strikingly crude and incomplete. It will be part of my task to consider reasons for the great differences in the delineation of Britain which those intervening decades made possible, and although we shall not be able to arrive at any very definite conclusions, nevertheless we can note certain factors which seem to have exercised an important influence.

The Gough Map has rather an obscure history: we know neither the name of its author nor the precise date of its construction. Richard Gough, the eighteenth-century topographer, was the first writer to draw attention to it,[1] but he could throw no light upon its origin except to say that Thomas Martin, who exhibited it before the Society of Antiquaries in 1768, believed it to belong to Edward III's reign. Some time later Lelewel referred to it in these somewhat enthusiastic terms: "l'unique monument de ce genre donne une idée de l'adresse de l'époque et des cartographes postérieurs, dont le produit topographique est perdu pour nous," and generously ascribed it to the twelfth century. This however is an absurd dating for which he offers no supporting evidence.[2]

About sixty years ago a photozincographed reproduction of the map was made by the Ordnance Survey. This appeared first of all in 'Facsimiles of National Manuscripts of Scotland,' published in 1871, but four years later it was published as a separate map together with an explanatory pamphlet by W. B. Sanders.[3] In the absence of any definite information regarding the origin of the map, Sanders made a careful study of certain internal evidence, with special reference to Scotland. He formed the opinion that the map was drawn up during Edward I's reign, probably about A.D. 1300, a dating which has not been questioned, I think, until recently, when, on the authority of Dr. Craster of the Bodleian, I stated that from the palaeographical evidence the map was very likely constructed during the second quarter of the fourteenth century.[4]

Sanders's arguments in favour of the earlier dating may be summarized as follows: (*a*) Bridges shown at Perth and Achmore, but no mention of bridge over River Don built by Bishop Cheyne of Aberdeen in 1329; (*b*) no mention of ancient bridge built over the River Torridge at Bideford in the early part of the fourteenth century; (*c*) many Scottish earldoms marked, but not Douglas and Crawford, which were created later; (*d*) writing on Bardsey Island refers to bards of the Britons, who may be said to have been extinguished during the subjugation of Wales by Edward I in 1284.

The absence of bridges is not, I think, a very strong argument to use. Actually, very few bridges are shown on the map; there is one crossing the Tees above Darlington, another crosses the Ure below Ripon, and a third is shown over the Medway at Rochester, but we are certainly not to assume that these were the only ones in existence when the map was constructed.[5] I do not feel that the other two points are sufficiently strong to outweigh the

[1] Gough, 'British Topography,' vol. i, pp. 76–85.
[2] Lelewel, 'Géographie du Moyen Age,' vol. ii, p. 5.
[3] W. B. Sanders, 'Map of England and Scotland, probable date about A.D. 1300.'
[4] Report of International Geographical Congress, Cambridge, 1928, p. 145.
[5] See E. Jervoise, 'Ancient Bridges of the South of England,' 1930, and 'Ancient Bridges of the North of England,' 1931, *passim*.

palaeographical evidence, although I have a suspicion that the map was not all drawn up at the same time. Sanders mentions that several place-names have been inked over at a later date, and in at least one case I believe that a new symbol has been added, whilst in others an addition, such as a spire, has been made to a church. Let us as an example take Coventry, which is depicted as an important town surrounded by a wall. Now the author of the map was very careful in the construction of his symbols; he does not distribute walled towns indiscriminately over the map, and there is good reason for assuming that the inclusion of a wall in the symbol indicates that that town was in fact walled at the time. But Coventry had no wall in Edward I's time. The first stone was not laid until 1355, and it was many years before the wall was completed.[1] One would not suggest, because of this, that the map as a whole is of the late fourteenth century, but it does point, I think, to the possibility that some parts of it are of a later date than others.

When we turn to the question of authorship we are faced with a number of difficulties. Mediaeval cartographers in Europe fall into two main categories, the portolan chart makers and the Patristic School. At first the Gough Map does not appear to fit into either category; it certainly bears no resemblance to contemporary portolan charts either in regard to its shape or in the distribution of its topographical features, except perhaps in its mistaken idea that Scotland north of the Forth was completely severed from the rest of Britain by a narrow waterway which was bridged at Stirling. Reinhard[2] suggests that its coast-line is superior to that shown in the portolan charts because of the knowledge gained by the English seamen who at that period were beginning to compete with foreign merchants for a share in England's overseas trade. This however does not explain the wealth of detail shown in the inland portions of the map, for which other factors must be considered.

Edward I, by his expeditions into Wales and Scotland, took thousands of Englishmen into regions which they would not otherwise have penetrated, and it is highly probable that much of the information incorporated in this map was acquired either directly or indirectly as a result of Edward's operations. Reinhard seems to have suspected this (p. 65), but he was apparently not acquainted with the published itinerary of Edward I,[3] which was available when he wrote. This gives details of the King's movements throughout Britain during the whole of his reign, and when it is studied carefully in conjunction with the roads on the Gough Map, it reveals some points of interest. In Wales, for example, the map shows a road running along the coast from Chester to Carnarvon, and then turning south along the shore of Cardigan Bay. The north–south section of this road seems to coincide for a short distance in north Cardiganshire with the Roman road[4] which skirts the Dovey estuary on the south, and we find that during the late autumn of 1284 Edward I passed along the coast from Carnarvon *via* Criccieth,[5] Harlech, Bere

[1] C. Gill, 'Studies in Midland History,' pp. 6–7.

[2] W. Reinhard, 'Zur Entwickelung des Kartenbildes der Britischen Inseln bis auf Merkators Karte vom Jahre 1564,' p. 70.

[3] H. Gough, 'Itinerary of King Edward the First.'

[4] According to the Ordnance Survey Map of Roman Britain, 2nd edn.

[5] Erroneously described by H. Gough as belonging to Carmarthenshire.

Castle (Merioneth), "Swaynestone," Aberystwyth,[1] and Cardigan to Haverfordwest, whence he proceeded along the Vale of Glamorgan to Cardiff and Bristol.[2] If any road were shown at all on the map on the western side of Plynlymon we should expect it to have some relation to the pilgrim route which ran from North Wales *via* Strata Florida to St. Davids, which must have been a well-known thoroughfare, with its hospices at Yspytty Cynfyn and Yspytty Ystwyth.[3] But it does not. This certainly is rather strong evidence against the supposition that the map was drawn up for the benefit of pilgrims, as I was at first disposed to think, but before accepting this as conclusive let us turn for a moment to a much more prominent pilgrim route in England. It might be argued that the so-called "Pilgrims' Way" between Winchester and Canterbury, which Belloc has immortalized as the "Old Road," would certainly be shown if the map had been intended for that purpose. It is not shown however in its entirety. A road from the south-west of England runs *via* Winchester, Alton, and Farnham to Guildford, thus coinciding with the western half of the Old Road, but at Guildford, instead of continuing eastwards to Canterbury, it is deflected to London *via* Kingston. This raises the problem as to whether the Old Road was in fact used during the Middle Ages to the extent that is usually supposed. F. C. Elliston Erwood[4] has summarized a number of arguments to show the improbability of its having been used as a commercial thoroughfare on anything but a very small scale, and, when making a careful survey of the route a few years ago, I came to the same conclusion. The absence of the Kentish section of the road from the map need not therefore rule out the possibility of the map having been drawn up for the use of pilgrims, but, on the other hand, Canterbury does not stand out as prominently as we should expect, and, to take another case, Bardsey Island, which has been referred to as "a British Rome,"[5] where twenty thousand saints are reputed to have been buried, merely contains the statement: "Bardsey ubi sunt Britonum vaticinatores" (bards of the Britons). Taking into account also Reinhard's observation (p. 73) that certain important religious settlements such as Durham are not shown with a cross, whereas crosses are placed over lesser monasteries at King's Lynn and Shoreham, and in the absence of any definite supporting evidence from the roads, I am inclined to doubt whether the map was drawn up for the guidance of pilgrims.

It is more difficult to explain the omission of the London–Dover section of the Watling Street, which we know to have been a very well-trodden route. The map, it is true, was never quite completed: the Scottish rivers, for example, have not been lined in as have those in South Britain, but, on the other hand, south-east England is complete apart from this road. In fact a road beginning at Southampton has been inserted along the south coast to Canterbury. I have never heard it suggested that this was a pilgrim route, although one cannot fail

[1]Given as Llanbedr in Merioneth by H. Gough, but the rendering "Lampadervaur," given in a footnote, shows that it must have been Llanbadarn Fawr (the old name of Aberystwyth).

[2]H. Gough, *op. cit.*, vol. i, pp. 160–2.

[3]Yspytty is the Welsh form of the Latin "hospitium."

[4]"The Pilgrims' Way, its Antiquity and its alleged Mediaeval Use," in *Archeologia Cantiana*, vol. xxxvii, pp. 1–20.

[5]G. Hartwell Jones, 'Celtic Britain and the Pilgrim Movement,' p. 362.

to recognize that such a thoroughfare passing through Chichester, Lewes, Battle, Winchelsea, and Rye would have made an admirable road for continental pilgrims landing at Southampton en route for Thomas à Becket's tomb. The main objection to the contention that the Pilgrims' Way was an important mediaeval highway is that it did not pass through any towns where food and shelter could have been obtained.

Now let us turn to a brief consideration of the map as a whole. Reinhard has calculated (pp. 67–8) that the length of England compared with that of Scotland is as 1·45 : 1·0, instead of being as 1·8 : 1·0, and the distances from Land's End to the Isle of Wight and from thence to the South Foreland are as 1·58 : 1·0 instead of being as 1·35 : 1·0. There is thus a tendency to exaggerate the extremities of Britain, which has persisted for another two hundred years. If we omit the misshapen peninsula of Scotland the scale is remarkably near one in a million. It is difficult to account for the curious form of Scotland, which did not really improve until the mid-sixteenth century, and also of Wales, where the omission of the Lleyn Peninsula of Carnarvonshire gives the west coast a convex appearance. The details of Wales do not follow the description given by Giraldus Cambrensis in his 'Itinerary through Wales,' and 'Description of Wales,' although it is just possible that a map of the principality drawn up by that author but subsequently lost may have been known to the fourteenth-century map-maker who used it as a rough basis for his work (Gough, *op. cit.*, vol. ii, p. 481).

Topographical details of England and Wales on the map may be considered briefly under two headings, viz. physical features and roads. With few exceptions the main rivers and their tributaries are very well delineated, the sources in each case being depicted as circular, a feature which is essentially mediaeval and one which is cited by Reinhard (p. 65) to prove that Moritz was mistaken in thinking that the map belonged to the sixteenth century. Three lakes are shown, one of which appears to be Windermere, another is placed southeast of Carlisle, and a third lies in the Pennines to the south of Bradford. The islands of Ely and Axholme are marked, but they, like the lakes and islands off the coast, are grossly exaggerated in size. Snowdon, the Cheviots, and the Cumberland Mountains are shown, but Plynlymon is erroneously coloured in as a lake. The New Forest and Sherwood Forest are each indicated by a tree, but the forests of Arden, Dean, and Inglewood are merely named. The Weald is not mentioned—a rather surprising omission.

We can support Gough's claim (vol. i, p. 84) that "the greatest merit of this map is, that it may justly boast itself, the first among us wherein the roads and distances are laid down." Over 2500 miles of roads are drawn in, about half being Roman or probably Roman, but none are shown north of Hadrian's Wall. From a detailed study[1] of the south coast road referred to above I concluded that the figures along the road indicate *leucae* or leagues, which were equivalent to about a mile and a half in modern measurement, although the distances given seem only to be approximate and must not be relied upon too strictly.

In spite of its defects however this is a remarkable map, and it is unfortunate

[1] *Sussex Archaeological Collections*, vol. lxxii, pp. 178–84.

that it should not have received better treatment in the past. Basire's engraving of it in Gough's book (vol. i, p. 76) is very poor, and Gough's figures for distances along the roads are unreliable; Lelewel's engraving of the map (Atlas, plate 24) is on too small a scale to be of any use; in 'Facsimiles of National Manuscripts of Scotland' several mistakes occur in the transliteration of place-names, *e.g.* Aberystwyth appears as Abergavenny, the length of Anglesea is given as XXXIIII millia instead of XXIIII millia, and several place-names are omitted which, although very faint, can be deciphered. When this has been done and all the roads have been examined in relation to contemporary records of transport and communications we shall perhaps be better able to appreciate the value of the map. This is the line of investigation I am hoping to pursue.

Several sixteenth-century maps of Britain bear a striking resemblance to the Gough Map as far as the general outline of South Britain is concerned, as I have tried to show in tracing the origin of certain errors which appear on maps of that century,[1] and there are other grounds for supposing that the map, or a copy of it, was well known to cartographers at that later date. The question then arises as to where it was kept. The network of roads suggests that it had a utilitarian value and gives the impression that it must have belonged to a person or persons for whom travel was a matter of considerable importance. Those most likely to need a map of this kind were pilgrims, merchants, or the King. We have already noted certain objections to its having been constructed for pilgrims, whilst the inclusion of detail for remote areas in Central Wales and Scotland is difficult to explain if the map were used solely by merchants. We are left with the possibility that a king, probably Edward I towards the end of his reign, conceived the idea of having a map made of the whole of his realm, especially as that realm had just been enlarged by the conquest of fresh territory with which he would need to establish communications. It is not unreasonable to suppose, I think, that the collection of material required for the map was begun in Edward I's reign, that it may even have been incorporated in a map which has since been lost, and that the Gough Map as we know it is a somewhat later and unfinished copy of the original. This later copy may perhaps have been kept at Westminster for reference purposes, and we may suppose that additions would be made to it from time to time. I readily admit that this is largely speculation, but it does help to explain the conflicting nature of much of the internal evidence which is all we have to work upon at the moment.

III. AEGIDIUS TSCHUDI'S MAPS

EDWARD HEAWOOD, Librarian R.G.S.

Through the kindness of Dr. J. Monroe Thorington we have received excellent photographs of an interesting series of MS. maps of the British Isles by the noted Swiss historian and geographer of the sixteenth century, Aegidius Tschudi, which have hitherto attracted less attention than they deserve. They form part of a larger series, of which scattered notices have been given by Swiss and other writers, but which has never yet been carefully

[1] *Archaeologia Cambrensis*, vol. 87, pt. i, pp. 194–9.

studied. The maps, some fifty in all, are preserved, with other MS. matter left behind by Tschudi, in the Library at St. Gallen, and were mentioned by Bagrov in the work reviewed in the *Journal* for June 1931 (p. 562), through which Dr. Thorington's attention was first called to them. Being specially interested in early Alpine cartography, in which Tschudi played so important a part, Dr. Thorington took steps to obtain photographs of such of the maps as related to the Alps, and he courteously offered to do the same for the maps of the British Isles as likely to have a special concern for British students. For the purpose he received the kind help of the librarian at St. Gallen, to whom, as well as to our correspondent, our thanks are therefore due.

Bagrov's account was avowedly based on somewhat imperfect notices, and we are told that it needs revision in some particulars. He mentioned only three maps of the British Isles, though there are in fact five sheets in all; two really form one map, of which another is more or less a duplication, while the last is little more than a fragment. They are:

1. *Scotland;* 2. *England.* Two full-sized sheets, each doubled, forming together a complete map of Great Britain, 42 × 64 cm. These two sheets, here reproduced on a reduced scale, are discussed in some detail below. It will suffice here to call attention to the primitive, mainly Ptolemaic, outlines of Scotland, and to the double (in part triple) series of place-names—ancient and modern—not usually found together on one map. Even among the modern names some are in Latin, others in English form, and one (Londres) in French.

3. *England and Scotland* together, on two sheets joined, the whole folded in four and measuring 43 × 63 cm. The scale appears to be slightly larger than the first, but in its general outline and content this map is largely a repetition of the other, again with dual nomenclature, though in some cases more prominence is given to the ancient than to the modern names. A few are found here which are not to be seen on the other, and there is some difference in the relative positions of places.

4. *England, Scotland, and Ireland,* 34 × 42 cm. Reproduces the Ptolemaic model for the whole of these islands, with the usual distortion of outline. The names also are mainly those of Ptolemy, with a few modern equivalents added.

5. *South-West England.* A small map, 17 × 12 cm., showing the south-western extremity of England (Cornwall, Devon, and a small part of Somerset) on a scale not greatly different from that of the general map, so far as it is possible to judge from the somewhat discordant outlines and positions of places. It adds practically nothing to the data in the larger maps, and the reason for the special representation of this portion is not obvious. Possibly it represents a first draft made in anticipation of the general map, or this region may have had some special interest for Tschudi.

Dr. Thorington remarks that the drawing of the maps may be assigned to the period between 1525, the end of Tschudi's Alpine travels, and 1560, the year in which he began to work on his 'Gallia Comata.' A more precise anterior limit may perhaps be obtained by comparing the maps with the "Anglia" given by Münster in his Ptolemy of 1540. For the English part, the general outlines are virtually identical in both, and it can hardly be doubted that Tschudi took these from the Ptolemy map, and that his English maps were therefore drawn after 1540. It is true that in the case of the Switzerland it was Münster who

was the copyist, and not *vice versa*, but here we know just how Tschudi's original had come to Münster through Glareanus, and that Tschudi had been inclined to complain that his map and booklet had been printed without his knowledge. It is unlikely therefore that he should have sent others of his maps to Münster. As the maps now in question show no trace of a knowledge of the Lily map of 1546, Dr. Thorington is inclined to put the drawing of the former at least before 1550, but a slightly later date seems indicated by the following consideration.

It will be noticed that Tschudi gives in the map margins an arbitrary graduation numbered along the top and bottom from 1 to 24, while on the sides he shows some hesitancy, giving different series of numbers side by side, starting from different origins. Although no such numeration is to be seen in Münster's Ptolemy Map of 1540, with which the geographical outlines agree, we do find one in all the modern maps in the edition of 1552. The question arises, did the idea originate with Tschudi, and was it taken over from him in the Ptolemy of 1552? This seems negatived by the "Epistola" prefixed to that edition by the German grammarian Lycosthenes, who expressly claims the authorship of the marginal graduation, to be used for reference purposes (see note on "Early Map Indexing," in the September number of the *Journal*). As the number of divisions in the lower margin of the Tschudi MS. exactly agrees with that in the printed maps of 1552, we cannot suppose the graduation to have been independently evolved, and we are driven to conclude that the 1552 Ptolemy was already known to Tschudi when he drew his map. A widely disseminated printed map is far more likely to have been copied than a single MS. specimen.

Tschudi's general map of Great Britain, here reproduced, may now be examined in some detail. So few are the surviving links in the early history of the mapping of these islands that any new document bearing on the subject is welcome. As Tschudi is not known to have visited this country, it might have been thought that he would merely follow some previous authority when wishing to include maps of these islands in his general series. Yet his picture so far differs from any other known to us as to suggest that a good deal of personal work was put into its compilation. But the provenance of the new detail is far from obvious. Cartographical sources existing in the mid-sixteenth century were of three main classes. The first, represented by the crude efforts of Matthew Paris, could have given little help, even if known to Tschudi. The beginnings of better things, such as the Gough map in the Bodleian (*c.* 1340), or the much later Cotton map in the British Museum (*c.* 1540), would have supplied more trustworthy data, and it is possible that a copy of some such document may have come into Tschudi's hands. But as he would anyhow have had some knowledge of the more important places, their mere appearance on his map cannot prove a knowledge of the others. A third class is that of the Portolan charts, and, little as we might have expected it, there is some evidence of the use by Tschudi of some document of this class.[1]

[1]Gastaldi's slight attempt at a modern map of the British Isles, in the Venice Ptolemy of 1548, need hardly be considered, being so nearly contemporary with Tschudi's, and the data contained being so scanty. But the nomenclature is of some interest as an indication of the information in the hands of an Italian of the time.

The fullness of Tschudi's nomenclature, which strikes one at first sight, is in part due to the insertion of both ancient and modern names in one and the same map. For the ancient, he no doubt followed Ptolemy in the main. For the modern, he has copied Münster to some extent as he puts in most (though not quite all) of the latter's names, copying even some of his mistakes. He still has, for example, Silford for Guildford, and gives the one place shown in the Isle of Man as Kuschen (for Rushen, the castle built by the Stanleys at Castletown). Mercator gives this correctly as Ruschen (1554) or Y^e^ Castel Russyn (1564). But Tschudi adds a number of other modern names, a rough count of those (in England only) not given by Münster putting them at about eighty. Contemporary map-sources known to us are limited to two or three MSS., of which Tschudi can hardly have been cognizant, and Lily's well-known map printed at Rome in 1546. If this was used it must have come into Tschudi's hands after he had drawn the outline, but one can hardly think that, had he known Lily's map, he would have been content to put the new material into so faulty a framework as was supplied by Münster.[1] As is natural, many names occur in both, but there is also a considerable residuum of names given by Tschudi but not by Lily, nor by the author of the anonymous MS. map at the British Museum, assigned to about 1540 (Cotton, Aug. I. I. 9), although this is remarkable for its very full nomenclature.

The evidence of the use of a Portolan chart is naturally confined to the names on the coasts, and to comparatively few of these. In Cornwall, for instance, we find in the south both Godeman and Godester, identified by Kretschmer ('Die Italischen Portolane,' p. 565) with Dodman Point and Start Point[2] respectively, and a shoal or rock named Benedicte. Other names have alternative spellings taken from the charts, as Artamua for Dartmuth, Musaola for Mousehole. (It is somewhat singular to find the latter name, in its English form, among the few names inserted for Southern England in the modern map of France in the Ulm Ptolemy of 1482–86.) Other Portolan names appear on the coasts of Norfolk and Suffolk, *e.g.* Arforda, Bracamea (? Orford Ness and Brancaster, badly misplaced), C. Arois (for Harwich), and others not now to be identified.

There are clear indications that the early map-makers depended largely for their information on the old chroniclers, and it is no wonder that maps made on such a basis should be marred by mistakes and distortions. For Wales they no doubt fell back on Giraldus Cambrensis, and for Scotland on Boethius and Polydor Vergil. A source that may have been open to Tschudi is the description of the British Isles by Paulus Jovius, printed at Venice in 1548, which included matter communicated to him by Lily; and Münster's annotations to Ptolemy's text may have supplied some of the names and identifications. But there are still a good few names not accounted for, and their presence in Tschudi's map

[1] In one particular his map resembles Lily's—in the way in which episcopal and archiepiscopal sees are shown.

[2] The second identification finds support from much later Dutch charts which show the Start as "Goud Start" (gold-tail); to the Dutch this would suggest a bird's name. Start is no doubt the O.E. *steort*, a tail, but in the general sense of a headland, as in Bolt Tail farther west. The epithet "gold" has not been found in any English chart or document: Leland names the point simply "The Sterte" ('Place-names of Devon,' 1913, p. 332).

can only surprise us. We find marked, *e.g.*, such places as Athelney, Bosworth, Tamworth, Chertsey, the Mendips, St. Helen's, I.W., St. Nicholas (quite a small village near Swansea), and Lindisfarn; while Tschudi alone of the authorities named knows of Hull as Kingston (Hull being named also) and of Haverfordwest as "Haverfordium," given in addition to the form Arforda used by others. He is unusually strong on river-names, giving, for example, the Wensum ("Wensdon," applied to the united Yare-Wensum in its lower course), Witham, Soar ("Sura"), Lugg, and even the Seynt in Carnarvonshire. The Lizard appears as "Laizart" and Alderney as "Origny." Both had already appeared (in other forms) in the Portolan charts, but are not to be found in any of the other maps prior to Mercator. The conclusion suggests itself that Tschudi was probably in correspondence with some Englishman, such as Leland, well versed in British topography, for most of the above names are mentioned in the 'Itinerary.'

For Scotland, Tschudi's information has been much more scanty, and may for the most part have been taken from Boethius or Paulus Jovius. Münster stopped short at the latitude of Edinburgh, and therefore gave little help, and we find no correct idea of the shape of Scotland, shown so remarkably well by Lily, and even (apart from the N–S elongation) by the British Museum map of *c.* 1540. Tschudi has an inkling that the Ptolemaic orientation was wrong, but he merely compromises by giving the northern part a less decided twist to the east, while not venturing to improve the general form of the coasts. But even here his nomenclature shows some up-to-date knowledge by including a sprinkling of modern names, and in the indication of episcopal sees. A couple of names—Cupar and North Berwick—seem peculiar to his rough sketch among contemporary maps.

In the placing of the names on the map Tschudi naturally makes mistakes. He puts Surrey much too far west, in the longitude of the Isle of Wight, though the name is to be seen, partially erased, nearer its right position. Plymouth is in Cornwall, and St. Michael's Mount at the end of the Lizard. In Wales we find Carmarthen north of Aberdovey, and not far south of Criccieth; Milford north of St. David's; and Brecknock on the shore of the Bristol Channel. Cockermouth (placed fairly correctly by Lily) becomes the north-western peninsula of Scotland (Novantum Prom. of Ptolemy). In this Tschudi was apparently misled by Münster (or his predecessor Servetus), who in their annotations to Ptolemy's text put "Cockermonth" close to the same promontory.

In spite of such defects the document is interesting, and worthy of study by all concerned with the history of early British topography.

DISCUSSION

Before the papers the PRESIDENT (Admiral Sir WILLIAM GOODENOUGH) said: We have papers this afternoon from three people who have devoted much time to the study of some of the old maps of England. I will, if I may, introduce them to you. The first is Miss J. B. Mitchell. She is a Research Fellow at Newnham, where she herself was an undergraduate, and she is to speak to us of the maps of Matthew Paris, the famous historiographer of St. Albans.

Miss Mitchell read her paper.

The PRESIDENT: Such remarks as I have to offer I will reserve until the end, and I will now call upon Mr. R. A. Pelham to speak to us. Mr. Pelham is a lecturer in geography, and his subject this afternoon is the Gough map.

Mr. Pelham read his paper.

The PRESIDENT: I will not be so presumptuous as to attempt any introduction to you of Mr. E. Heawood. He is much more fit to introduce me than I am to introduce him. He will speak to us about the map of England by Tschudi, the Swiss monk.

Mr. Heawood read his paper.

Professor E. G. R. TAYLOR: I have only a few words to say, but I was very glad to find Miss Mitchell emphasizing the diagrammatic character of mediaeval maps. This diagrammatic character is not always, even by geographers, and certainly not by historians, fully understood. We know that the modern map has to be interpreted according to a number of rigid conventions, but the same is true of the mediaeval map also. Miss Mitchell showed us the example wherein Dover was placed in the centre of the south coast of England in order to emphasize its importance as a route terminal. This consideration is particularly necessary to bear in mind in respect to the relative sizes of various portions of the maps.

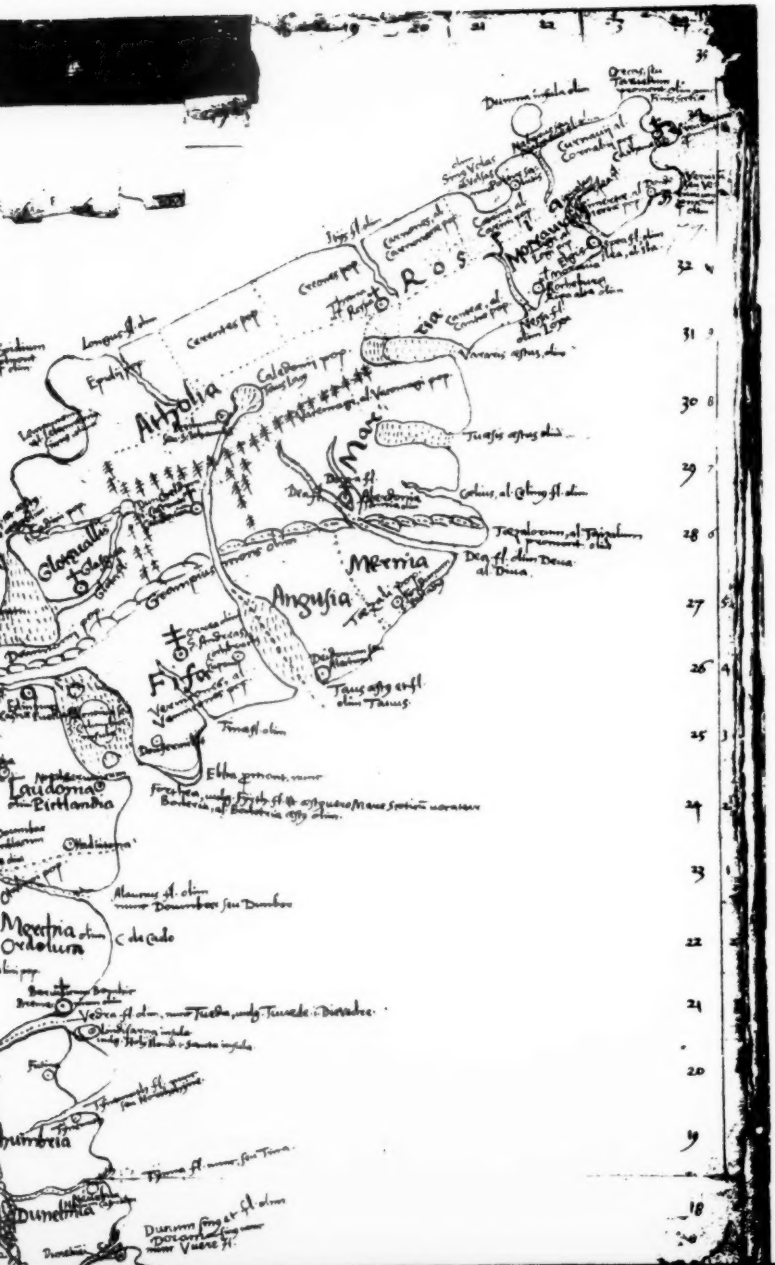
My point is rather well illustrated by Mr. Pelham, who said several times in the course of his paper that certain features in the map were "grossly exaggerated." What the mediaeval map-maker would have said was that they were "carefully emphasized" according to their importance. Miss Mitchell will confirm me in respect to the mediaeval maps of Palestine of the same group. The map of Palestine had Mount Carmel drawn as one of the most prominent features; that was because of the very great importance of Mount Carmel in scripture history. In the same way, in other maps, the islands to which attention has been drawn, and which were said to be exaggerated, were islands which played a great part in the political or religious history of the time. My point is that we must approach these maps only after having gathered a knowledge of the particular conventions which the mediaeval map-maker has employed. He was not attempting an oriented scale drawing, but he was putting on to a sheet of parchment the things he wanted to express.

The PRESIDENT: I always feel myself that what I would like to know very much of is the history of the people who made these maps. I have no doubt their history is very well known and could be followed. They were all, or nearly all, I suppose, monks, because it was only monks and priests and a very few others who possessed the requisite education in those days.

One thing which I noticed on the maps exhibited struck me: that map-making in its refinement—I will not say in its accuracy, for that is obvious—was very far behind many other things of the period, not perhaps so much in England as elsewhere. We look at the beauty of statuary and pictures and the accuracy that was shown in those arts in early times; but when we turn to the maps we find them relatively crude, as, for example, in their depiction of a range of mountains. In this country exceedingly beautiful things were produced, such as alabasters, as we may see them in South Kensington. Yet when it comes to maps we find how much out of proportion they were in many respects, especially with regard to the rivers. It was evidently quite time that there were geographical societies to assist the people in that direction.

I may not have understood Mr. Pelham rightly, but was he right in saying that the Pilgrims' Way from Winchester to Canterbury came up to London? I have walked along the Pilgrims' Way, or used to do so, fairly often, but I thought it

Argyllia
Elgauia
Carrita
Morthia olim Ordoluca
Nidisdalia
Northumbria
Gallouidia
Dunetinia
Monapdia
Laudonia olim Pictlandia


Athfolia
Mar
Mernia
Angusia
Fifa
Glotwalia
Laudonia
Mernia
Dumfriesia
Ros
Moravia

Two sheets of Tschudi's manuscript maps of the British Isles in the St. Gallen Library, repro

ary, reproduced from photographs supplied by Dr. J. Monroe Thorington

was far short of London that it turned to the east. The reason why it was put on the hill was partly that the pilgrims might remain dry shod, and partly that they might avoid robbers, who would attack them if they came down from their point of observation.

May I, in your name, thank Mr. Heawood and Mr. Pelham and Miss Mitchell. We have to thank them not only for giving us great enjoyment this afternoon, but for the immense amount of work that they must have put into these short papers. I know that the work of Mr. Heawood in particular is valued not only in this country but all over Europe and America. We have to thank them all for the very suggestive things that they have brought before us.

BEAR ISLAND

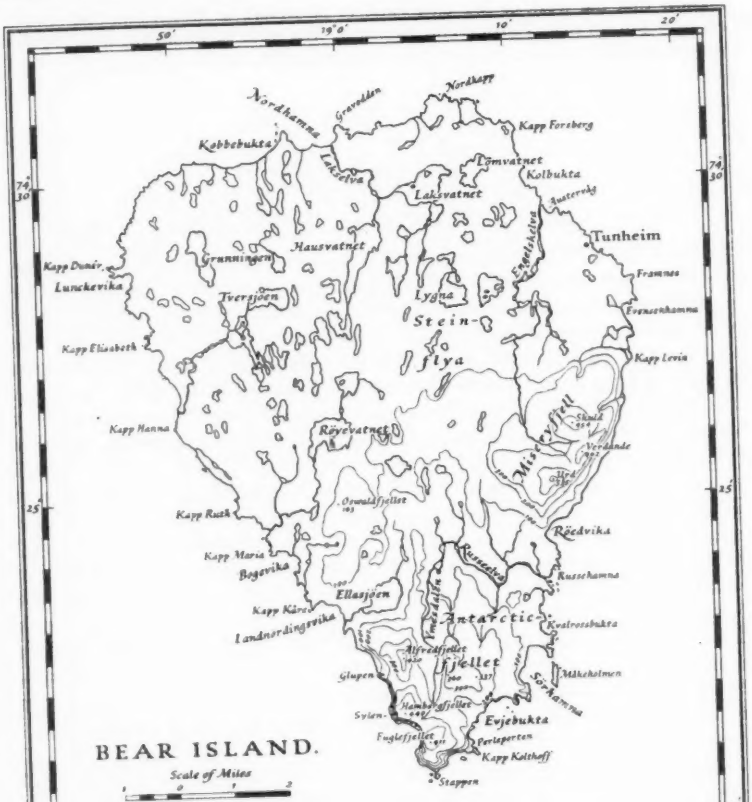
G. C. L. BERTRAM AND DAVID LACK

BEAR ISLAND (Björnöya), in the Barents Sea in lat. 74° N. and long. 19° E., was discovered as early as 1596, but it has not often been visited by scientific expeditions, and these have usually stayed for only a short time on their way to or from Spitsbergen. The only previous British expedition was the first Oxford University Expedition to Spitsbergen in 1921, which stayed from June 13 to 23 and confined its attention to the southern part of the island. In the years 1922–1925 the Norwegian Svalbard Expeditions undertook a detailed topographical and geological survey, and give an account, together with the first published history of the island, in the 'Geology of Bear Island' (Gunnar Horn and Anders K. Orvin, 1928). The main object of the present expedition, which was limited to two persons, was to study the animal life, of which little was known. We wish to record our deep gratitude to the Royal Geographical Society for its financial support, without which the expedition would probably not have taken place, and to our Colleges, St. John's and Magdalene, Cambridge, for their additional help. We would also thank Professor Debenham, Dr. T. G. Longstaff, and Mr. J. M. Wordie for their invaluable advice and assistance, Mr. Adolf Hoel, leader of the Norges Svalbard-og Ishavs-Undersökelser, for much useful information and a map of the island, and Professor J. Stanley Gardiner and all at the Zoological Laboratory, Cambridge, for their encouragement and practical help.

British trawlers regularly fish the Bear Island waters in the summer, and we were fortunate in obtaining a passage to the island on the *Arkwright*. We left Hull at 3 a.m. on June 14, sighted the mainland of Norway for a few hours on June 16, and the southernmost of the Lofoten Islands on June 18. So that as little time should be wasted as possible, the skipper decided to trawl for twelve hours before landing us. Accordingly, in the early hours of June 20, when we were 30 miles south-west of Bear Island, the trawl was shot for the first time. Fishing continued most of the day, and towards evening we rounded the north end of the island, and after considerable delay due to a dense fog were landed at Austervåg in the north-east.

Bear Island, being 120 miles south of Spitsbergen and 240 north of Norway, is one of the most isolated islands in the Arctic. In 1925 it was proclaimed

a Norwegian possession and came with Spitsbergen under the denomination of Svalbard. The island is roughly triangular in shape, with the apex to the south, and is some 12 miles across from north to south, and 9 from east to west. It can be divided into three regions: a flat plateau at about 100 feet in the northern half of the island, Mount Misery in the east, and other mountains in the south.



The northern plateau is flat to the west, gently undulating to the east, with a central rather higher area the Steinflya. The whole region is covered with a network of shallow lakes, none more than a few yards deep. Indeed, one-tenth of the total area of the island is covered by fresh water, and the great majority of the lakes are in the north. The two chief rivers of the northern region are the Engelskelva (English River), which has a winding course from Mount Misery north to the sea, and the Lakselva (Salmon River), which drains a series

of lakes, including the two largest on the island, Laksvatnet and Hausvatnet. The plateau is bounded seaward by steep cliffs, and there are few landing-places. Many of the streams enter the sea by waterfalls. Off-shore there are a number of picturesque stacks, and there are others in process of formation. The cliffs are being cut back rapidly, of which process there is one striking instance. There are some old graves on the north coast which were originally a little distance from the cliff edge, but the latter has been cut back so much that one of the coffins now juts out over the edge, and the dislodged limb bones have been placed under a stone beside the grave. The cliff face is especially liable to fall just after the snows melt, and on one occasion soon after our arrival a large rock fell within a few yards of us.

Mount Misery is an impressive plateau mountain with three peaks, of which Urd, at about 1770 feet, is the highest point on the island. Its ascent merely entails a scramble up a steep slope covered with loose scree, and the top can be reached without difficulty. From the summit a fine view is obtained of the northern plateau with its innumerable lakes. The southern mountains are divided by the Ymesdalen, a broad U-shaped valley down which flows the Russeelva (Russian River). To the east are the Antarctic Mountains and a line of coast which includes Kvalrossbukta (Walrus Bay), where the Oxford University Expedition camped in 1921. To the west and south are four flat-topped mountains—Oswald, Alfred, Hamberg, and Fuglefjellet. Between the two first lies Ellasjöen, one of the few lakes of this southern region. It is 140 feet deep, being apparently the deepest lake in Svalbard, and its bottom must be in places 70 feet below sea-level. Unlike the lakes of the northern plateau, it appears to be of glacial origin.

The southern end of the island is certainly the most impressive. The dolomite cliffs of Hambergfjellet drop sheer for over 1400 feet, and at their base is a sharp needle of rock (Sylen, or the Awl), 250 feet high. The cliffs of Fuglefjellet (Bird Mountain) are nearly as high and have at their southern point a remarkable series of high stacks, pinnacles, and arches. A little to the east is a bay surrounded on three sides by vertical cliffs which are nowhere less than 1000 feet in height. The strata lie horizontally, so that the place has the appearance of a vast theatre with every seat filled, for the sea birds, mainly Guillemots, are present in incomputable numbers, and crowd the ledges tier upon tier from a few feet above sea-level to the top. Farther to the east is Kapp Kolthoff, through which runs a tunnel, the Perleporten (Gates of Pearl), which is nearly 200 yards in length and is wide enough to admit the passage of a small boat.

The island is composed mainly of Palaeozoic limestones and dolomite, but in the north-east are coal-bearing Carboniferous sandstones, and the peaks of Mount Misery are made up of Triassic sandstone. There are no rocks of volcanic origin. Except on a few sheltered slopes, where there is a rich moss heath, the ground is almost devoid of vegetation. The limestone for the most part forms a smooth hard surface which makes fair walking. But this cannot be said of the sandstone. The whole north-east of the island is covered with loose angular boulders, varying in diameter from a few inches to over 8 feet. In some areas the boulders encircle clay centres, forming polygons, but in the earlier part of the year these offer no relief, for the walker as readily sinks into their soft clay centres as he stumbles on the loose peripheral boulders. As

a result of such terrain the two of us wore completely through five pairs of heavily nailed, and constantly renailed, boots in seven weeks.

On Bear Island the midnight sun lasts one hundred and six days, from April 30 to August 13, and the sun remains below the horizon from November 7 to February 4. The summer of 1932 appears to have been much later than usual. We were informed that until ten days before our arrival the sea was heavily encumbered with ice, and on June 20 we saw still a few fragments near the coast. On this date much of the land was covered with snow and only a few of the smaller lakes had thawed. The summer came rapidly however, and the largest lakes of the north-east were free of ice within the next ten days. The west side of the island was much later, most lakes being frozen on July 4, and some even in early August, when there was still much snow lying against the cliffs. The normal summer temperature is about that of Spitsbergen, the average for July, the hottest month, being 4·5° C. The winter is considerably milder than in Spitsbergen. The most remarkable feature of the summer weather is the fog. In fifty-two days we had clear skies for only five days, and thick fog with visibility limited to 30 yards for twenty-two days. After a clear spell the fog often came up from the sea in well-defined walls, and on one occasion we saw Mount Misery severed by a dense but clear-cut horizontal band which left the peaks and the foot of the mountain absolutely clear. We experienced only five days of rain during our stay, and, except during a short blizzard on July 15, the temperature rarely fell below freezing-point. On August 10, our last day, it actually reached 11° C. Icebergs passed not infrequently to the east.

Throughout the year the Norwegian Government maintains a meteorological wireless station at Tunheim in the north-east, and in the summer of 1932 the wireless operator, Mr. Fritz Oien, his wife and baby, his brother, and a cook, were living at the station. We had intended to live in one of the houses in the abandoned mining village of Tunheim, and it was an act of most welcome, and quite unexpected, kindness when the operator and his wife invited us to live and work in three vacant rooms of the station. In such a climate this not only added greatly to our comfort but enabled us to get through far more work than we could otherwise have done. The houses in Tunheim are still in fairly good condition, and with a little trouble could be made inhabitable. Round about is a confused debris of broken woodwork and rusted iron, also two steam engines, and quantities of dynamite, which have survived from the mining days. Half a mile to the north, at Austervåg, is the remains of a silo. The hand-winch here was of great help in lifting our stores from the beach up the 100 feet of cliff, although the whole structure appears in imminent danger of collapse.

We had originally intended to keep to regular hours, and to return each day at a given time, but the frequency and density of the fogs caused a change in our plans. The compass apparently varied irregularly (as reported in the Admiralty charts), and this, coupled with the similarity of the lakes and the boulder-strewn areas of the northern plateau, made it impossible to find the way inland during a thick fog. Consequently, when we were favoured with a clear day we made the most of it, and would walk for sixteen or seventeen hours at a stretch. By this means we were able to visit all parts of the island. We were of course assisted by the fact that the sun remained above the horizon

North coast of Bear Island: Kobbebukta (Seal Bay)

Southern cliffs, with Hambergfjellet (1400 feet) on right

Mount Misery from the sea

Looking north-east from Mount Misery

throughout our stay. On the days of thick fog we kept to the coast or worked inland near our base.

During our stay Norwegian fishing vessels called in not infrequently to send off wireless messages, sealing vessels occasionally, and for three weeks a whale factory was anchored in the South Harbour. The last appeared to have been successful, and we were informed that by early August the three catchers had accounted for just over two hundred whales. The flensed corpses, covered with sea birds, were frequent off-shore. On July 27 a sealing vessel came in with a sick man, who was given a room at the station for a few days until a fishing-boat called in on its way home, and took him to Tromsö. On July 18 a Norwegian carpenter arrived to prepare one of the houses in Tunheim for the Polish Meteorological Expedition in connection with the International Polar Year. The five members of the Polish Expedition, three of whom were staying the winter, landed on August 4 in a sealing vessel from Tromsö, which was also bringing some of the winter's supplies for the station. At this time there was an agreement among the Hull trawlers that they should not fish the Bear Island waters, so we availed ourselves of this ship, the *Sverre*, of Hammerfest, to return to Tromsö. We left the island at 10.30 p.m. on August 10, after a stay of seven and a half weeks, a characteristic fog blotting it from view within ten minutes of our getting under sail. We landed in Tromsö at 4 p.m. on August 13 and left again at 1 a.m. the following morning on the *Lord Dawson*, of Hull. We are extremely grateful to Commander F. W. Hawkridge, in Hull, for the trouble which he took in negotiating the passages for us on the trawlers; also to Mr. Höegh, harbourmaster, and Mr. Saether, British Vice-Consul, for their assistance in Tromsö; and to the trawler owners, Messrs. F. and T. Ross, of the *Arkwright*, and Messrs. Pickering and Haldane, Ltd., of the *Lord Dawson*, for their kindness in allowing us to travel on their ships. Finally, we must thank the skippers and their crews for their numerous kindnesses.

Past History

Bear Island was discovered in 1596 by the Dutch navigator Willem Barents, who gave the island its name as the result of a fierce encounter with a huge bear, which resisted their attacks "with muskets, hargubushes, halberdes and hatchets . . . while foure glasses were runne out." Gerret de Veer's account also states that some of the crew were in great danger of their lives "for that going up a great hill of snowe, when we should come down againe, wee thought wee should all haue broken our neckes, it was so slipperie, but we sate upon the snowe (*ons naers*) and slidde downe, which was very dangerous for vs, for that at the foote of the hill there were many rockes, which we were likely to haue fallen vpon, yet by Gods help we got safely down againe."

The next reported visit to the island was by the English. A ship fitted out by Sir Francis Cherrie, of the Muscovy Company, landed in 1603. Subsequently the island was named Cherrie (corrupted to Cherry) Island, a name still found on some maps, though it is falling into disuse. In the succeeding years the English were frequent visitors, and in 1605 a party in distress gave Mount Misery its name. On one occasion, in 1604, Stephen Bennett and his companions are reported to have killed between seven and eight hundred walrus in six hours. The account states that "when all our shot and powder

was spent, wee would blow their eyes out with a little pease shot, and then come on the blind side of them, and with a carpenter's axe cleave their heads." The great herds of walrus continued to attract hunters, especially the Norwegians, until the animals were eventually exterminated round the island, some time in the early nineteenth century. Heaps of skulls in Nordhamna and Kvalrossbukta (Walrus Bay) bear testimony to this once flourishing industry.

In 1899 two German firms set up rival claims to the island with a view to working the coal, but little came of this. It excited the attention of the Russians however, and an expedition was sent out to seek the remains of huts used by the early Russian hunters. The Russian flag was hoisted on the north coast over a skeleton found wearing Russian boots, and a board was put up to the effect that this area belonged to Russia. With this, the Russian activity seems to have ceased. From 1905 to 1908 a Norwegian company used a land whaling station in Kvalrossbukta. In 1915 another Norwegian firm claimed the whole island to mine the coal, and the village of Tunheim in the north-east was built. In 1920–21 as many as one hundred and eighty-two persons wintered, and until the end of 1925 there was a moderate output of coal. Then came the slump in prices, and the mines were closed, since the completed topographical and geological survey of the island showed the purity and thickness of the seams to be insufficient to make it profitable to continue. Since an attempt to mine galena in the south in the summer of 1926, the members of the wireless and meteorological station have been the only inhabitants of the island. Bear Island was proclaimed a Norwegian possession in 1925, in accordance with the treaty of 1921.

Some fifteen scientific expeditions, beginning with Keilhau in 1827, have visited Bear Island. But almost all have stayed for only a few days at most. In 1864 A. E. Nordenskiöld returned with a rough map, and in 1898 the Swedish Polar Expedition under Nathorst made the first adequate survey. In the following year three of the latter's companions stayed for two summer months, mainly occupied with geological work. The members of the Oxford University Expedition to Spitsbergen in 1921 appear to have been the first Englishmen to have stayed on the island since the hunters of the early seventeenth century. From 1922 to 1925 the Norwegian Svalbard Expeditions made a complete topographical and geological survey. Mr. Adolf Hoel kindly gave us a copy of the map, published in 1925, which proved reliable and of great assistance.

Fauna

The main work of our expedition was the study of the animal communities, both land and freshwater, to discover the relationship of the various animals to the physical conditions, to the plant life, and to each other. At the same time the position of Bear Island, between Norway and Spitsbergen, makes its fauna of great interest from a zoo-geographical standpoint. The detailed results will be published later in the appropriate journals.

Both the plant and animal life of Bear Island are extremely sparse, more so than in much of Spitsbergen. Indeed Summerhayes and Elton (*Journ. Ecology*, vol. xvi, August 1928), when classifying Spitsbergen into four zones on the amount of plant life, include Bear Island among the most barren of these.

The freshwater lakes contained an abundant fauna of Crustacea, also one species of Water Mite and the larvae of Chironomids (Midges) and Caddis Flies. In addition there was the Arctic Char, which made excellent eating. Around the lakes, and on islands in them, were nesting Ducks (Eider, Long-tailed, and Scoter), Divers (Red-throated and Great Northern), and Arctic Terns. These birds fed mainly at sea, but to some extent on the fauna of the lakes. The only other freshwater community is that in the streams. Where these were swift-flowing they contained the larvae and pupae of a Simuliid Fly, also Chironomid larvae. The smaller land animals consisted of numerous Springtails, adult Chironomid Flies and Mites, each group represented by some twenty species. There were a few other Flies, but other insect orders were poorly represented. Of Hymenoptera there were three species of Sawfly, whose larvae fed on willow, and two or more Ichneumon Flies. There were five species of Beetles, all five different from the four recorded from Spitsbergen, one Caddis Fly, and one Moth. In addition there were two species of Spiders. The above animals were found mainly under stones or in decaying matter. Almost none flew about, although on the rare occasions when the sun was visible some of the insects visited the flowers. The plant life, as already mentioned, was extremely sparse. This was related to the exposed condition of the island, for in the few sheltered places plants, especially mosses, grew quite thickly. Of the higher plants, Arctic Willow, Saxifrages, and Buttercups were the most common. Some areas, in especial the Steinflya, in the centre of the island, were devoid of vegetation. Yet even here a few Springtails and Spiders were to be found under the stones.

Although species were few, individuals of a particular species were at times present in astounding abundance. Thus on one occasion the cast pupal skins of Chironomid Flies (each some 10 millimetres long and 2 thick) formed a sludge over a yard wide and several inches thick all round a large lake from which the adults had recently emerged. This was paralleled by an incredible swarm of living Collembola (Springtails). These insects, which are only some 2 millimetres long and less than 1 thick, were seen covering the ground, forming a solid black carpet, over an area 10 yards long and 1 yard wide, and the individuals were in places crawling several deep on top of each other. The cause of this swarm was the extensive manuring produced by the droppings of Gulls.

There was only one common land bird, the Snow Bunting, which fed mainly on the above-mentioned insects. There were also a few pairs of Ptarmigan and a single pair of Starlings, this being the farthest north that this enterprising species has yet spread. There were two land mammals, the Polar Bear, which visits the island only in winter (three being seen by the staff of the wireless station last winter), and the Arctic Fox. We saw about ten of the latter, and watched one stalk and kill a Puffin. Sea birds must be their main diet during the summer.

It remains to mention the sea birds, which are probably the most interesting feature of the island fauna. Nor is this interest limited to the birds themselves. In such barren conditions the manure produced by the birds counts for far more than it does in more temperate latitudes. Plants, especially the Scurvy Grass, which were normally of stunted growth, grew almost luxuriantly in

places where they received such manure, and certain interesting Beetles and Dung Flies were confined to the neighbourhood of bird colonies. The sea birds include the Kittiwake, Glaucous, Herring, and Great Black-backed Gulls, of which the last two are not found farther north and have colonized Bear Island only within recent years. Others are the Arctic Skua, Fulmar, Little Auk, Puffin, Razorbill, Mandt's Black Guillemot, Brünnich's and Common Guillemot, of which the Razorbill and Common Guillemot do not breed farther north than Bear Island.

The southern cliffs are perhaps the finest bird cliffs in the northern hemisphere. Not only, as already mentioned, do the Guillemots crowd the available ledges on the huge expanse of vertical cliff face, but in many places they have overflowed in unbelievable numbers on to the flat areas above the lower cliffs. We were able to scramble down to some of these colonies, where the birds were crowded so closely together that the ground was almost completely concealed. The parent birds scarcely heeded our presence and allowed us to stroke them as they brooded their eggs or chicks. They were apparently unable to recognize their own offspring, which were often interchanged in the frequent scuffles, and we saw one bird attempting to brood as many as ten young at once (each bird has only one of its own). The confusion, noise, and smell were indescribable.

Owing to our good fortune in arriving on Bear Island before its summer had begun, we were able to make a continuous seasonal survey of the fauna up to August 10, and it is probable that all species of animals on the island had emerged by this date. The Bear Island fauna is, in its general features, found to be the same as that of Spitsbergen, but there are certain differences that are of interest. As previously noted, the island is classed on its vegetation with the most barren of the four Spitsbergen zones. But the fauna is considerably richer than that typical of the barren zone in Spitsbergen, and includes forms such as Sawflies, Caddis, Moth, certain Dipterous Flies, and two Spiders, which are found only in the warmer parts of Spitsbergen. This is perhaps because the summer lasts longer on Bear Island than in the typical barren zone of Spitsbergen. But the inner fjords of Spitsbergen enjoy a better climate than Bear Island, and some animals found there, such as a Mosquito, a Hover Fly, a Weevil, an Aphid, and certain Spiders, were not found on Bear Island. On the other hand eight species of Bird, five species of Beetle, and of freshwater forms a Simuliid Fly, a Water Mite, and three Crustacea occur on Bear Island and have not been found in Spitsbergen. In these species Bear Island forms the most northerly limit of their geographical range. There is strong evidence, to be published shortly in the *Ibis*, that some of these more southern birds have colonized Bear Island only of late years, and they will doubtless spread to Spitsbergen in due course. The presence of the freshwater forms on Bear Island and not on Spitsbergen will perhaps be explicable when the physico-chemical composition of the lakes has been worked out. It is curious that the Beetle faunas of Spitsbergen and Bear Island should have not a single species in common.

Elton (*Trans. Ent. Soc. Lond.*, 1925, p. 289) concludes from his survey of the fauna of Spitsbergen, that Spitsbergen has had no land connection with Norway since the last glacial period. What was known of the Bear Island fauna favoured

this view for the latter island also, and our detailed survey fully confirms this. All the animals found on Bear Island are capable of crossing the sea either by walking across the ice, by flying, or through being blown. (Recent work has shown that even flightless forms such as Springtails, Mites, and Spiders can occur at great heights in the air, and so could be transported by wind.) On the other hand there is an absence of forms which would find it extremely difficult or impossible to cross a stretch of sea. These include such mammals as the Lemming and Hare, large Ground Beetles, Molluscs, and Planaria, forms which occur in other parts of the Arctic, whose absence can be explained only by the separation of Bear Island from the mainland since its last glaciation.

LA CROISIÈRE JAUNE

L. V. S. BLACKER

SOME of the greatest travellers of the past have been men who for one reason or another, whether from poverty, or from the need to escape savage fanaticisms or the attentions of robbers, have been compelled to journey afoot or on the backs of sorry jades.

There have been epics of travel created by the man whose only implement has been the HB pencil. At the other end of the scale are logically planned expeditions whose organization is the fruit of much foresight, ingenuity, and prudent experienced reflection. In the past such ventures have generally been sea-borne, because ships were the only means of transporting considerable loads of apparatus. The limit of the land traveller's gear was set, until recently, by the camel, the ox wagon, or the sledge.

Drake, Magellan, Cabot, and James Cook were accustomed to carry quadrants, mariners' yokes, logs, charts, and even astrolabes and chronometers in an epoch when shore-going explorers scarcely aspired to a pocket compass. There is food for thought in contrasting the equipment of H.M.S. *Challenger* with that of her contemporaries on land: Speke, Livingstone, Vambèry, or Prjevalski. To-day aircraft and the cross-country motor vehicle are beginning to redress the balance. Aeroplanes and airships have made every point on the Earth's surface accessible to the traveller who has the determination to reach it; whilst the motor has shown the beginnings of a power to carry the heavy scientific instruments of a large expedition. Georges Marie Haardt and Louis Audouin-Dubreuil were pioneers who foresaw the use and value of the new weapons.

Their journey, or, as they prefer to call it, cruise, across Asia was the third of a series. In 1922–23 they had made their first venture on the Citröen-Kegresse half-track cars, by means of which they traversed the Sahara from north to south. This was soon followed by the Croisière Noire which, under the same chiefs, and with similar machines, traversed the African Continent from Algeria to the Cape, and thence to Madagascar.

The machine which rendered it possible to carry out these journeys in the space of a very few years deserves description. It is the product of the firm of Citröen and is mechanically not very dissimilar from an orthodox motor

car except as regards the all-rubber, flexible, caterpillar tracks, and their multi-wheeled bogey, which replace the back wheels of the conventional vehicle. The tracks are driven by a robust back axle which is itself driven from a standard gear-box connected by specially low ratios in the differential and in reducing gears on the bogies. The engines used in the thirteen cars of the Croisière Jaune are of the standard Citröen design, of 75 mm. bore and 100 mm. stroke working at a maximum of 3300 r.p.m. with six cylinders and side-by-side valves. To cool this engine in the high atmospheric temperatures encountered and at low forward speeds it was found necessary to provide special radiators with exceptionally large cooling surface conjoined with condensers devised to obviate any loss of the precious cooling water. The speed in top gear was 33 km. per hour, the weight of the tractor being 2800 kg., and of the trailer 600 kg.

The front wheels and axle do the steering and are of conventional pattern, but strongly reinforced to meet the extra stresses. In these later types a steel cylinder or roller is mounted on a transverse horizontal axis between the dumb irons in front, so as to clear the ground by 8 inches when on the level. On meeting soft sand, mud, or a trench, this roller finds contact, lifts the front of the car clear, and thus enables the immensely powerful thrust from the tracks to push the whole vehicle over the obstacle rather than into it.

The cars were equipped with a variety of special tackle to assist them over rivers and over the more formidable gaps that were encountered. This gear comprised power-driven winches, steel cables, snatch blocks, derricks, portable girders and the like, which reflected great credit on the foresight, technical skill, and imagination of its designers. The duraluminium bodies of the cars displayed no less ingenuity. Incorporated therein, in the most compact form, were 500-watt short-wave wireless sets with 16-metre masts for transmission and reception, automatic rifle-calibre weapons, travelling cookers of admirable efficiency, known as the "Wagon Restaurant," filters, condensers, and even wash-basins and mirrors, besides tentage and cots. One car included a workshop and a dispensary which could be converted into an ambulance. Everything could be brought into use with the least possible expenditure of time and energy, on the site of the night's bivouac, and with a minimum of fitting together. Every item represented an intelligent employment of the fruits of past experience, and there is reason to suppose that every item was justified by subsequent use in the field, even to the guns. The petrol tanks had a capacity of 450 litres, enough for 400 miles over rough ground.

With material equipment on this scale and of this quality it was natural that the leaders should plan out the objectives on the grand scale. They designed to bring "the major portion of Asia more within the sphere of the world's knowledge in the same systematic and complete way that the Trans-African expedition had done" in another continent. In the sphere of archaeology they proposed a reconnaissance of ancient remains in Syria and 'Iraq, and more especially in the monasteries and sanctuaries of Chinese Turkistan. They planned an ethnological study of the native races and their cultures, to be illustrated by paintings, films, photography, and collections of handicrafts. The geographical objects were to map out routes, to record gradients, and to study important land and air lines of transportation. They projected research

in short-wave wireless, and planned to collect economic information in the larger commercial centres. Besides this, collections were to be made for museums, and the artists of the expedition were to use brush and pencil for the benefit of science as much as of art. The recording equipment included apparatus for colour photography, and for sound pictures as well as silent films.

Haardt believed that in our time the whole face of Asia is rapidly changing, and that Western ideas and customs are spreading everywhere with surprising rapidity. He wished therefore to cross the continent and to preserve for the future a picture of the Asia of to-day by means of photographs, sound and moving pictures, paintings, and by placing data of all sorts within the reach of every one.

The expedition comprised two separate echelons: the one led by Haardt was to start from Beirut, while the other, commanded by Lieut. Point of the French Navy, was based on Peiping, whence it would move westwards *via* Kalgan across Mongolia to meet Haardt and his caravan at Kashgar, in Sinkiang.

Haardt had gathered together a staff whose attainments and efforts formed an invaluable complement to his own leadership. His immediate assistant was M. Louis Audouin-Dubreuil, and with him there were, originally: Father Teilhard de Chardin, geologist and paleontologist; M. Hackin, archaeologist and Principal of the Guimet Museum; M. Reymond, naturalist; Doctor Delastre; Doctor Jourdain, mountain specialist; M. Le Fevre, historiographer; Lieut. Pecquer, French Navy, geodesist; Mr. Owen Maynard Williams, representing the National Geographic Society of Washington; Mr. Young, an assistant of the Geographical Department of China; M. Sauvage, in charge of cinematograph work, assisted by Specht, Morizet, and Sivel, as operators; M. Andre Goerger, General Secretary. The total was brought up with mechanics and drivers to forty-two.

The first group, equipped with a somewhat lighter type of vehicle, six in number, left Beirut on 4 April 1931, whilst the heavier group, with seven machines, set out from Kalgan, on a westerly course, on May 17. M. Yakovlef, a Russian artist, joined the light group later. He painted a considerable number of vivid pictures depicting the many tribal types encountered.

The light group, led by M. Haardt himself, passed through Baghdad and Tehran without incident. After a cordial reception from the Crown Prince it left Tehran on May 5, reached Meshed on the 12th, halted there for four days, and then crossed the Afghan frontier at Islam Qal'eh on the 19th. Another day found it at Herat, where again there was a four-day halt. The onward journey lay through Girishk and the group arrived at Kandahar on June 4.

In Persia no great difficulties had been encountered except for torrential rains which made quagmires of the roads without however delaying the programme. In Afghanistan there were additional troubles owing to the rains having swollen the streams. Thus it took four days to cross the Helmand, whilst for the Arghandab crossing the cars had to be hauled through the water by cables and their winches. Nevertheless the group reached Kabul on June 8, after 400 miles on the highlands at 6000 feet, having encountered the greatest courtesy from the inhabitants and the local administrations.

Meanwhile Lieut. Point's heavy group reached Peilingmiao on May 22 and

arrived at the Edsingol river on June 8, after a 1000-mile traverse of Inner Mongolia, encountering two violent sandstorms in the Gobi. Unbroken wireless contact was from now onwards maintained between the two groups, and with the outer world, which received M. Haardt's reports with regularity.

From Kabul to Srinagar was uneventful, except for a hitch caused by the barbed wire in which Peshawar has immersed itself, but this stage marked the end, as the travellers put it, of the easy and pleasant portion of the route. The whole journey from Beirut to Srinagar, crossing Afghanistan from west to east, had taken less than three months, and this without undue haste.

But from Bandipura onwards M. Haardt's group was confronted by the stupendous obstacles of the Himalaya and the Muztagh, over which no previous traveller had even so much as contemplated a journey in any sort of vehicle save aircraft. The wireless car, which weighed 4 tons, had to be left in Srinagar, whilst the other vehicles were lightened and distributed into three sections.

The first started out from Srinagar on July 2 under M. Hackin, but the others were delayed by floods in Kashmir until the 19th. In four days this section reached Gurais, covering 80 miles over a pass of nearly 12,000 feet (Rajdiangan or Tragbal), involving a sheer climb of 7000 feet, zigzagging up a steep spur, barely passable by a loaded pack pony and never before attempted by a loaded camel. The crossing of the Dorikhun, 13,000 feet, was, as might be expected, a task to daunt the boldest, but it was achieved in spite of snow 10 and 12 feet deep, though some of the load of the cars had to be transferred to ponies. In places the edges of the path broke away under the weight of the vehicles. Thus they came down into Astor, but from here on even more formidable difficulties threatened the venturers and brought out the value of the excellent gear with which the expedition had been provided.

The track between Astor and Bunji, which is for the most part cut into and built out along the face of tremendous cliffs, had been undermined by rains, and the full story cannot be told or appreciated until the expedition publishes its records and films. In spite of difficulties all three sections passed the Himalaya, and reached Gilgit on August 4, to the surprise alike of primitive barbarian tribesman and of travelled European.

Another 60 miles saw Haardt's group of cars in Hunza, where they were fated to remain. In front, the narrow track is built up on wooden baulks from the face of the cliff, all far too weak to sustain even an unladen car. At that time of the year, too, the Hunza river is a swollen rushing torrent which forbade a passage up the relatively level but bouldery valley-floor. No doubt it would have been sound policy for the expedition to have waited until September or October for the river to subside, for then the cars could very probably have been got through to the Pamir. Grombchevski, the adventurous young Polish captain of Cossacks, came down, it will be remembered, in 1892 to Hunza with a whole Sotnia of his men. This, in those days, was a remarkable achievement in itself, in view of the remoteness of the place from the most forward Russian posts, but Grombchevski left it on record that in his opinion a coach and six could be driven from Gulcha through Bordebe, the Ulugh Dawan, Murghabi, and the Kilik to Baltit. Subsequent travellers will bear him out, so that the disappointment of all M. Haardt's friends must be the more intense when they realize how near he came to forging every link of his long chain. He had

however no permission to enter the territory of the U.S.S.R., and even had he driven his cars up through Kanjut and over the Kilik, he would still have been stopped by the gorges of Tangitar or of the Gez.

Be it as it may, the cars were left behind and the group replaced machines by animal transport in order to meet their comrades of the heavy group, which had not reached Urumchi till July 15, on account of the disturbances amongst the Musulman Chantos of the New Dominion. The French members of the group testify to the value of the co-operation in this section of Colonel Vivian Gabriel, whose local experience and energy was of much assistance, and also to the help and advice of Major-General Sir E. D. Swinton.

The Haardt party reached Kashgar on September 19 and quickly pushed on to Aqsu, where they joined up with the four cars sent on by Lieut. Point from his heavy group. By employing wireless Point had been able to obtain his time to within a fifth of a second, and hence his longitude, with corresponding accuracy. The two groups thus united retraced the trail to Urumchi, which they reached on October 26. Nearly a month was spent here in overcoming the obstruction of the Viceroy of Sinkiang, overhauling the cars, and preparing the special equipment needed for the Mongolian winter journey which lay ahead of them.

They arrived at Qomul on December 11 somewhat embarrassed by the fighting which was taking place between the forces of the Republic and various groups of Musulman rebels who had besieged the city for four months. These matters caused a delay at Qomul, which was unwelcome because of the intense cold, if for no other reason, but after another halt at Suchow the combined groups reached Kangchow on December 24 and Liangchow on the 29th, in spite of the looting of two of their petrol depots and further delays from military officials at Suchow. Here the intensity of the cold (−30° C.) made it impossible to stop the engines at night.

Now they were well embarked on the southern road from Sinkiang into China, whereas Lieut. Point had travelled to Qomul by the northern route. The itinerary through Mongolia lay south of that of Dr. Roy Chapman Andrews, and north of the routes of Sven Hedin, and hence enabled new material to be inserted in the maps. Sandstorms made progress difficult, but after crossing the sand-dunes which form the fringe of the Alashan desert they came up to the left bank of the Yellow River on January 10. The crossing was made by ferry, but sandhills on the bank, several hundred feet high, constituted a formidable obstacle.

They reached Ningsia on the 13th to encounter the ill tidings that fourteen badly needed spare caterpillar tracks had been looted by bandits, and were compelled to set to work to repair their old ones. Then they set out again from Ningsia on January 18, originally with the idea of crossing the Hwang Ho on the ice at that place. This was found to be too thin, so M. Haardt was forced to modify his plans, to abandon the traverse across the Ordos desert, and instead to follow the great bend of the Hwang Ho, risking the dangers of an attack by armed bands. They halted with the Belgian missionaries at Santaoho and set out again for Paotou on January 24. Not only did they encounter hurricanes of wind, raising immense volumes of sand which served to test the engines and their air filters to the uttermost, but they were attacked near Patsebolong, about

100 miles from Paotou, by a force which opened fire on them. Here the light automatic guns with which the cars were armed came into action, and returned the fire of their assailants. Somewhat surprised at this unexpected resistance, the attackers called a parley, gave themselves out as regular soldiers, and pleaded a misunderstanding. Fortunately no casualty was suffered to the personnel, but one of the cars alone sustained eleven hits. The expedition reached Paotou on January 26 and spent some time repairing the damage caused by the fire of the troops.

The next incident was a search for Buddhist relics and records in the group of lamaseries at Peilingmiao. After experiencing the extreme cold of the high Mongol steppes, where the thermometer went down to −30° C., and a visit to the Mongol Prince Hsisu-Ming at the Chinese New Year, they reached Kalgan at dawn on February 8 and Peiping (Peking) on the 12th. Thus the immense journey was over and the enterprise of Citröen, the genius of Kegresse, and the leadership of Haardt had reached the goal of their efforts. M. Haardt had planned to take ship to Hanoi and thence to traverse Indo-China, Annam, Siam, and the Malay Peninsula. From there he would embark for India, re-cross the great Peninsula and Persia, and return to Beirut across the deserts of Arabia. The whole world will deplore his untimely death, which not only prevented the accomplishment of the ambitious return journey, but has deprived the world of travel of an outstanding leader, a great organizer, and a man of imagination. Since his decease, the tragic death of Lieut. Point, his able coadjutor, has inflicted a further loss.

It is too soon to attempt any analysis or appreciation of the results of this Asiatic journey, for they have not yet been made public. Some of M. Yakovlev's pictures have been shown to those interested, and they form a contribution to the complex ethnography of Asia as interesting as it is picturesque and graphic. For the rest, it is hardly to be expected that the scientific results could be continuous and complete, because of the innumerable interruptions, both from outside interference, in the disturbed atmosphere of China, and because of the immense physical difficulties encountered, *inter alia*, in the crossing of the Himalayan range. None the less, their publication will be awaited with the greatest interest as a foretaste of what the future may bring forth from this type of organized land travel.

At the Evening Meeting of the Society on 21 March 1932 the President said: Everybody will regret the death of Georges Marie Haardt, who passed away in Hong Kong on March 15 at the age of forty-seven. He was not what we in this Society would call a great geographer, but a great organizer of travel; a fearless man who was prepared to make use of all the most modern intelligence to go where he wanted to go; and with it all a very charming, modest, and delightful companion. We have sent a message to Paris to say how much we regret his death.

SURVEY ON THE LABRADOR COAST

[*We are indebted to Captain J. A. Edgell*, R.N., *Hydrographer of the Navy, for permission to publish this very interesting letter addressed to his predecessor, Vice-Admiral Douglas, by Captain A. G. N. Wyatt*, R.N., *commanding H.M.S. Challenger, the survey ship now operating in Labrador waters.—Ed. G.J.*]

WE are now on our way to Halifax for oil, after which I hope to be able to hold out to the end of the season and sail direct for England from Labrador without replenishing again. As we have now had about six weeks on the surveying ground I think you might like to have some news apart from my various letters of proceedings. First of all, the ship is very satisfactory and handles beautifully, but I have not yet had an opportunity of judging her in heavy weather as we have scarcely had a breeze of any weight at all. The shallow echo-sounding gear has been satisfactory except for the usual wear and tear, and I think that really every surveying ship should have two sets, if it can be managed; especially working in Labrador waters, where I can scarcely move without running it, and the gear gets very hard work indeed, occasionally for twenty-four hours uninterruptedly. The direction-finding gear we have so far had little occasion to use. The self-recording thermometer has given excellent and most interesting results, of which Nagle, of the Meteorological Office, is keeping complete record; a particular instance being a change of temperature of 4° F. on the change of tidal stream in the runs owing to ice lying along the coast, the flood being that much colder than the ebb.

We left St. John's, N.F., on July 7 and had an uneventful passage as far as Cape Harrison, where we arrived on the evening of the 9th and anchored in Webeck Harbour for the night; this is not a bad little harbour and better charted than most on the coast. There were two icebergs aground in the entrance, but they just left comfortable room for us to pass; one had gone by the morning and the other "calved" just as we passed it, which might have been alarming if the calving had been bigger. At St. John's we took on board Captain Clarke, an old sealing master, fisherman and lately master of the N.F.G. mail steamer running down to Labrador. From Cape Harrison onwards his services were a great help to us whenever we encountered pack-ice, of which naturally I had no experience and should not have known just what was navigable in a vessel of this sort, and probably should not have tackled it without his help; he was very reliable so long as we were on the track he was used to, but once we had to depart from that he confessed that he was just as ignorant as we were, and as we were never on the track he knew after rounding Cape Harrison he was not able to guide us much from that point on. I think it probable that we shall have to rely on ourselves entirely when on the coast; fishermen are not to be trusted, because although they are perfectly able to take their own vessel about they are entirely at a loss in a ship of even slightly greater draught, instances having been known of men who have used a run or harbour for years in safety in one vessel, on taking command of another with only 2 or 3 feet more draught coming to grief on their first voyage, and in waters which they thought they knew thoroughly. The rocks rise from great depths with alarming suddenness, and only the other day when sounding out

a run and getting depths of 30 fathoms and more we suddenly got 15, then 5, and on sending the boat to examine the area found a rock with 8 feet within a ship's length; the ship can therefore only be used with the greatest caution even in the deepest water, which necessitates moving about very slowly if the boats happen to be engaged elsewhere and cannot be sent ahead.

We arrived at Hopedale on July 10 without difficulty, though in one part the chart and sailing directions were quite unintelligible, and Captain Clarke's local knowledge of great value. Hopedale is a tiny mission village and Hudson's Bay Post, but has a W/T station which is in communication with Newfoundland and Canada, and is the fortnightly port of call of the mail steamer; it is the most northerly port that the steamer can be relied on to reach, as, although they schedule two trips a year to Nain, she has not succeeded in getting so far as that yet this season. This is mainly because she always sticks to the same route through the outer islands and there is apparently insufficient inducement for her to try and find another through uncharted waters. The outer routes are far more subject to pack-ice, fog, and icebergs than is the one right inside the islands by which the *Challenger* went, and if she had used this there is no reason why she should not have reached Nain early in July, as the Hudson Bay schooner *Fort Garey* did. It therefore seems clear to me that both from a naval and commercial point of view the first essential is to survey a safe track right along inshore; an outer route can then follow with passages joining the two, leaving the intervening areas to be surveyed as opportunity offers later on. In the meantime the passage to the extreme north can always be made in safety, once the ice has gone, by passing well off-shore where conditions are much better in the following respects: (1) The water is deep and probably clear of dangers; (2) fog is somewhat less frequent than close in to the islands where the cold Davis Strait current seems to hug the coast; (3) icebergs are less frequent, as they seem to congregate mostly in the main stream of the current and get hung up amongst the off-lying islands and shoals; (4) the current against a vessel proceeding to the northward is, I think, less strong.

We left Hopedale the following day for Nain, but pack-ice was close in to the outer islands, so we had to take the inner runs; even here drift-ice was pretty thick and we were constantly under helm to avoid the "pans," as the seamen and fishermen call them, or "glacons," which, I believe, is the scientific term. At Cape Harrison there was a narrow lead between the pack and the Cape, but owing to fog coming down at that moment we were unable to round the Cape and had to find anchorage in Windy Tickle. Here we were hung up till late the following afternoon, when the fog lifted, and we got under way. Meanwhile the pack had closed in, but there was just room to pass between it and Cape Harrison, and this we did only to find loose pack stretching right across our course from the land right out to the main pack offshore. Here I was most grateful for Captain Clarke's advice, and after consultation decided to try and proceed; and once we started to tackle it I soon got confidence and could tell just what the ship was capable of and what to avoid, the main anxiety being my propeller; as soon as we had to deviate from the track known to Captain Clarke we could never be sure what water there was ahead. After about 5 miles of this the pack was seen to be getting much closer on the route we wanted to take, but inshore by the inner runs the sea was clear. I therefore

decided to abandon Captain Clarke's track and take the one inside Massacre Island described in the Sailing Directions. It was quite a relief to get clear of the ice and only to have the depth of water to think about without any heavy floes to avoid. From this onwards we proceeded, often with the boats ahead, as soundings on the chart were so far apart as to be really no safeguard, and we sometimes had to anchor while the boats made sure in which direction safe water lay; carrying on in this manner we arrived at Nain on July 14. It seems, at present, to be quite impossible to forecast the conditions of ice from year to year. For the past ten years or more the coast in this latitude has been clear of pack-ice before July, whereas before that it was quite the usual thing for the pack to be in right through July and sometimes even to mid-August. Nain is another mission village and Hudson's Bay Post, and has a population of four or five white people, including the missionary's wife and daughter, and three hundred Eskimo and half-caste settlers who live in the district round about. On going ashore I was agreeably surprised to find gardens with several sorts of flowers, potatoes, and rhubarb growing, and also lettuces under glass. This is the oldest missionary station on the coast, having been founded in 1771. The Eskimo here still stick to their native clothing, which was not so much the case at Hopedale, though it is largely made from materials (calico, duffle, etc.) bought from the Hudson's Bay Company for summer wear; but their winter clothes and boots are still entirely made of seal and caribou skins. There are still one or two of their sealskin kayaks left which they use for seal hunting in spring, but all their other fishing is done from motor "trap skiffs," open boats about 30 feet long with a small engine-house and cuddy. We left Nain for Port Manvers on July 16 with a local settler as guide, and he was able to point out where the shoals lay and which was the correct run to take, though here Dr. Forbes's sketch-map and Mr. Wheeler's reconnaissance map were also of some assistance. We got as far as the narrows south of Port Manvers without difficulty, and there we anchored while the boat went through to find the channel which is very narrow but carries 6 fathoms; an extra obstacle was provided by large pans of ice which started to drift through with the tide. However I made the attempt, and with care got right through to the southern entrance to Port Manvers, though there was one alarming moment when fog closed down suddenly and I had no safe anchorage owing to the strong tide and ice. Luckily it lifted again almost at once. Our efforts after all were of no avail, as on opening up Port Manvers we saw it blocked from shore to shore with ice. There was therefore nothing else to be done but turn back and begin our survey at the first feasible point; I had noted one or two on the way up. Sites for base measurement are few and far between, and even the best require a good deal of preparation before they are suitable for measurement along the ground. The one I chose, about 8 miles northward of Nain, was on an island in the run, 7622 feet long with very good possibilities of extension. It took us a fortnight to prepare it, as small embankments had to be made over swampy ground and across a couple of watercourses, but in the meantime the base triangulation was reconnoitred, marked, and observed, and a suitable site obtained for further extension up and down the coast; astrolable sights, and tide and current observations were also obtained. At the time of temporarily quitting our survey, sounding and coast-lining of the inner run

between Nain and Port Manvers were well in hand, and I left Baker in charge of a party to make a plan of Nain.

The weather has not been too good, I am told abnormally bad for the time of year, spells of three or four days' fog and rain coming between spells of two or three days' clear weather, and if we had not had our labours on the base to occupy us we should only have found surveying possible on about half the number of days. From local report and personal observation it seems to be a very general rule that easterly winds bring fog and rain and generally bad weather, while westerly winds give fine and clear conditions at this time of year; but the fog does not seem to extend more than 20 miles or so inland, as we often saw the hillsides in the interior bathed in sunshine when we were in fog and drizzle.

On July 20 Mr. Wheeler, the American geologist who made the reconnaissance map with which I am supplied, called on board in his canoe; he has spent several summers on the coast, and I found his experience interesting, as during conversations with the missionaries and Hudson Bay traders I had formed the opinion that much useful work could be done in triangulation and coast-lining between March and June, and he confirmed this, having done a good deal of his mapping at that season. The following are some of the points in support of this suggestion: (1) In the spring, after February, the weather has settled down, the days are often very fine and clear, the snow is hard, and travelling by sledge both by land and over the sea is good and far easier than in the summer-time; even the outer islands can be visited without difficulty and stations made, whereas the ship would have to feel her way to them with the greatest care. Hill climbing is easier and coast-line can be walked in with ease. (2) Komatiks with dogs can travel at about 5 m.p.h. or 60 miles a day; therefore one could triangulate and coast-line 120 miles each side of Nain (or the base) without being absent from the base for more than about a week at a time. (3) All rocks and shoals with less than about 2 fathoms over them are shown up clearly by the ice bulging and piling up over them owing to tidal action, and it is therefore a simple matter to visit them and fix their position all ready for sounding in the summer. (4) There should be no difficulty in observing and booking observations if a windbreak is provided and washleather gloves are worn. (5) Eskimos, with their dogs and komatiks, can be hired at from $2.40 to $2.50 a day; but if engaged for the whole winter and provided with a seal net they would also keep the camp supplied with firewood and food, and their wives would do domestic work, all at a cheaper rate. Frame wood houses and stores would have to be imported. (6) A party of two surveyors and their recorders with a steward and camp keeper would probably be sufficient. (7) The party could be employed drawing fair charts, etc., during the months November, December, and January; they would of course have to be left behind by the ship, as there is no communication with the outside after November. (8) All the white residents, including the women, are agreed that the winter and spring are much the pleasantest time of the year, though of course there are stormy spells. (9) There are no mosquitos or black flies.

On July 27 Dr. Forbes's Air Survey party arrived in their seaplane on their way up north to continue the survey begun last year, and we put them up for the night. Dr. Forbes sent a message with them offering the services of their

plane to take any photographs I might require after they had done their work. They had a schooner as a base, and she arrived the following day, when they all left for the northward. On August 9 they arrived back again, having completed their survey of 150 miles of coast-line, and again offered to do anything I might require, and so I asked them to photograph a strip between Ford's Harbour and Cape Harrison, stipulating that we should supply petrol for their schooner to make up for fuel expended by their seaplane on our behalf. I also went up with them and took Jenks and Anstey, our photographer, and we flew over the route that I had followed in the ship on the way up from Cape Harrison; it was a very interesting experience and gave me an excellent idea of the ground, and we located one dangerous rock near our track; ordinarily the bottom does not show up from aloft at greater depths than 2 fathoms, owing to its dark colour, but under 2 fathoms it shows up very light, presumably because it is scraped bright by the ice in winter-time. The islands along this stretch of coast are almost innumerable, and the general appearance of the relation between land and water is that of the pieces of a jigsaw puzzle scattered on a blue cloth; the work of placing them all correctly on the chart and sounding the passages between must take years and years, and it therefore seems very necessary that the first consideration should be to survey two tracks, one inside the islands and one outside, with convenient passages connecting the two and good anchorages where necessary. The country inland is exceedingly rough, well wooded in parts, but broken up by many inlets of the sea, some running 30 miles or more to inland lakes and ponds scattered everywhere and at all levels. I only saw two rivers of any size. On completion of the photographic flight the plane left for the south, and the photographs, when developed, will be forwarded to the ship.

The ice finally left the coast about August 1 or 2, but as I was in the middle of my triangulation and had a party detached it was not convenient to leave the survey to obtain the oceanographical observations required off the coast. I therefore postponed this until the 15th, when I left Baker behind at Nain and sailed for the offing. We ran a line of soundings and carried out a running survey of the passage towards Ford's Harbour until fixing failed, and on leaving Ford's Harbour we entered a labyrinth of uncharted islands, rocks, and shoals, and noted several breakers, past all of which we felt our way, constantly under helm and sometimes having to go astern or turn back and try a different passage. We reached our first station, northward of the Hen and Chickens Islands, in the afternoon, and here the sea was dotted with numerous icebergs. I counted over sixty in sight at one time dangerous to navigation, and many small bergs and growlers, the larger ones all apparently aground; luckily the weather was clear. After the second station, about 12 miles seaward of the outer islands, the bergs ceased and there were no more sighted until we made the land again. The Davis Strait Current impinges hereabouts on the Labrador Coast, bringing its cargo of bergs which get hung up amongst the islands and shoals until they melt; only a small percentage pass on to the southward, and the most we sighted at one time south of this was twenty off Cape Harrison: there were only three off Round Hill Island. We finished "bottling" on August 16 and stood inshore again till we made the Hen and Chickens, after which we ran a line of soundings along the coast to

the southward and thence proceeded for Halifax. Off Cape Harrison we discovered a large area of magnetic disturbance, the compass needle being deflected 10° or more either way, but the remarkable fact was that the depth of water in which this occurred was, except at one spot, all over 50 fathoms, and in places over 100 fathoms. A full report of this is of course being prepared.

Fresh meat and potatoes have held out very well, being issued on alternate days, and as fresh fish can be had for the taking there has been no hardship in this. We got one replenishment of potatoes through by motor boat, but this cannot be counted on another year. We have had two mails, one forwarded from Hopedale by motor boat, the other brought by the seaplane. I think it very unlikely that we shall get farther north than Port Manvers this season; coasting is such a slow business that I think it wiser to get as much surveying done as possible in the locality in which we have started and thoroughly reconnoitre the coast to the southward; then next season a reconnaissance northward can be made. North of Cape Mugford I am told that the character of the coast entirely changes, being very bold with deep fjords and few off-lying islands or known dangers; one gathers this also from the Sailing Directions.

I expect to remain at Halifax until Saturday, August 27. I want to give the ship's company a spell. Recreation in Labrador is really non-existent, as there is no level ground for games which is not swampy, and the mosquitoes and flies make landing, without some very definite object, anything but pleasurable. Salmon and trout fishing so far has been disappointing, as there are no rivers just where we are working, and the sea trout will not rise to the fly, only taking a spoon trolled behind a boat. Even of these we have not had many, though the natives catch plenty in nets. It was too early to get any shooting, as all the birds were nesting and no deer or caribou come down to the coast at this season. However in spite of these little drawbacks every one seems quite happy and the survey is exceedingly interesting.

A. G. N. WYATT

H.M.S. Challenger, at sea. 20 *August* 1932.

SOME NORWEGIAN MAPS

THE *Mitteilungen des Reichsamts für Landesaufnahme* is doing us a great service by describing the maps and underlying geodesy of the Baltic States. Each article, devoted to its separate survey, is illustrated by samples of the various scales and editions. It is of one such article, on the official cartography of Norway, that I will speak now. It is illustrated by ten plates of which one is a triangulation diagram. The remaining nine are an epitome of Norwegian cartographic history.

The very first, oddly enough, is the only one in which we find neither that tiresome kind of script called "engrossing" in England, and used by German draughtsmen for mountain-names, nor the italic sloped backwards for water-names. Every letter is either upright or sloped in the manner usual to a right-handed penman. Is this the influence of Cassini, one wonders, and was it later overshadowed by German fashions? Like the plate which follows, Number 1 is copper-engraved and hill-shaded in the horizontal form-line fashion in which the Ordnance Survey made those 6-inch and 2-inch hill sketches which served as a basis for hachuring. Both the first and second are on the scale of 1/200,000.

The third map (1/100,000) includes a rather poor conventional hachuring in parts and on the more pronounced slopes a hill (or stump) shading in brown. The light is vertical and the general effect good. The date of this sheet is 1872, and it is the only one described as coming from a *rektangelblatt* (though the Rondane sheet is also rectangular). The others are all in those geographical sheet-lines which are such a curse when special district or area maps have to be patched up from existing plates.

The next extract is from a 1 : 100,000 of 1923. Scandinavian craftsmanship is, generally speaking, excellent, and this map bears witness to it. Unfortunately it attempts to do the work of a 1 : 50,000. With all its fineness and beauty in detail it wants a magnifying glass, whilst the mixture of types and the many left-handed sloping names further confuse the issue. The fifth example is a useful small scale (1/400,000) which shows however the same overcrowding.

Plates 6 and 7 are the *pièce de résistance*, but first a modern 1/25,000 (1931—Plate 8) should be mentioned. This is a clear pleasant four-colour map. Relief depends wholly upon contours, of which every fifth is reinforced. Some of these sheets are published evidently as ski-maps, for Plate 9 shows such a one. A ground tint is added and the normal roads have been taken off to give place to ski-ways. The 1/20,000 and 1/25,000 maps, so general on the continent, are extraordinarily useful. With all the richness of our British material we have too large a gap between the 6-inch and the 1-inch.

In Plate 6 we strike a different note. Here is a very pleasant 1/250,000 (practically a ¼-inch) which gives a vivid impression of relief. To start with, it is always a joy to find maps of a "metric" country at a scale which can be converted easily into so many miles to the inch!

The sheets of this series (each of three degrees of longitude by one of latitude) are of a sensible size. They are cleared of superfluous or unnecessary detail and names, and the nine colours are beautifully matched and very transparent. Tops have a slight golden tint towards the westerly light and a brown shading on the shadow side. Violet is used as a second shadow below snow-level. The hill shading has both vertical and oblique emphasis, but is so cleverly done as to round off where slopes are obviously convex and so to escape the usual fault of hill shading. On this plate indeed the brown shading gives the concavity of the slopes below the crags (which seem almost universal), whilst the violet emphasizes the convexity below. The two blues are clear and bright. Valley bottoms are

picked out in pale green, and if we consider that green plate as part of relief treatment we find no less than five of the nine printings devoted to it. The one weak spot in this carefully thought out plastic scheme is that it gives a poor idea of relative height.

But we have kept the best wine to the last. This is a tourist map, and I gather the only one of its sort, at 1/100,000 in eleven colours. The sheet is to my mind too small (roughly one degree of longitude by 20 minutes of latitude) whilst the margins obviously consider silence golden; but those are minor matters compared with the beauty of the physical treatment. The general idea of the shading is that of the previous map. The black detail, light and dark blues and red-brown contours, are the same as in former maps. A green wood plate and red roads are additional. The shading takes the same five plates as before, viz. buff for sunlit slopes, brown and grey-green, violet and pale green for shadows, drawn, I think, with crayon on the plates or stones. As before, the weak spot is a failure to introduce the impression of relative height. In the new 1-inch an attempt is made to give that badly wanted "relative" sense by an unobtrusive layer, but somehow a layer would not go on this map.

The woods are delightfully shown in a coarse hand-drawn stipple for "bush," including separate deciduous and conifer symbols. These woods are so cleverly done as to leave the sense of relief unimpaired whilst brightening the map generally. Of course the treatment is expensive. This Rondane sheet is an *édition de luxe*, and it is a little difficult to concede it the value of four printings over the Skye ½-inch (seven printings). The names are better written and printed than in the other maps we have mentioned. The same engrossing and left-handed slopes do appear, but it seems that those alphabets must be used on Norwegian maps to coincide with official and administrative records. A political flavour enters into their choice, we are told, and, if so, it is a mercy perhaps that they are not worse. I wish we had had the pleasure of having designed and printed this map at the Ordnance Survey.

H. STJ. L. W.

REVIEWS

EUROPE

THE PERSONALITY OF BRITAIN: its influence on inhabitant and invader in prehistoric and early historic times. By CYRIL FOX. *Cardiff: National Museum of Wales and Press Board of the University of Wales* 1932. 10½×8 *inches; 84 pages; maps. 2s 6d*

The word "Personality" in the title is a bold metaphor used to signify physical factors or characteristics, such as position, form, structure, climate, flora and fauna. Its use is merely a matter of brevity of wording, and does not affect the argument of this "study of Britain as an environment for Man." Dr. Fox gives us a useful "sketch of the essential Britain," as, for instance, at the dawn of the Iron Age when the movement of native and invader was canalized and shepherded along belts of open country, mostly above the environing forest of the lowlands of damp oakwood. His pages represent an address delivered at the International Congress of Prehistoric and Protohistoric Sciences in London, in August 1932. The subject is fully illustrated by three coloured maps and a valuable series showing the distribution of archaeological material and where early Man lived in successive periods. S. E. W.

THE THREAT TO THE PEAK: the Peak District: its scenery, disfigurement and preservation. With a foreword by G. M. TREVELYAN, O.M. *Sheffield: The Council for the Preservation of Rural England—Sheffield and Peak District Committee* 1931. 11½×8½ *inches; 94 pages; illustrations. 2s 6d*

ON FOOT IN THE PEAK. By PATRICK MONKHOUSE. *London: Alexander Maclehose* 1932. 7½×5 *inches; 196 pages; illustrations and sketch-map. 5s*

The Peak District is an area of hill country which culminates in the high plateau of Kinderscout, but as to whose boundaries there is no general agreement. The C.P.R.E. volume however takes them as extending, roughly, to Dovedale on the south, Glossop and Buxton on the north, and the outskirts of Sheffield on the east. The central and southern regions of this area are noted for their limestone dales, but this charming and often enlightening volume with its well-chosen illustrations does good service in showing that the grassy hills which rise high above these valleys in themselves possess great beauty, and often afford even finer views than can be found within them. From the heights the eye can follow for miles the curving course of a stream in these much-contoured landscapes; whereas from the banks of the river itself the view extends no farther than the next curve. This somewhat unfamiliar but highly characteristic feature is admirably illustrated in the excellent view of Dovedale taken from the Nabbs. This book is of great value in the attention it draws to the combined geographical and geological features of one of the most interesting and attractive parts of England, and the photographs, both in choice of subject and in technical skill, are worthy of their purpose; those of "High Tor," at Matlock, and "Above the Mist on Kinderscout" are of great beauty.

Interesting notes are given on the characteristic Derbyshire high moorlands which terminate in what are locally known as "Edges." These are natural walls of gritstone beneath which the ground falls steeply in irregular faces. Though comparatively straight and level, when seen from below they often present a jagged skyline which is equally impressive against a blue sky or stormy grey clouds.

In contradistinction to the former volume, Mr. Monkhouse does not concern

himself with the human interest of the region of which he writes. The hills and dales, the wide moorlands and the open spaces, how to reach and to traverse them, it is all these which engage his attention and arouse his enthusiasm.

Opening with a discussion on the meaning of the word "Peak" he quite correctly contends that it does not merely connote the rugged and lofty mass of Kinderscout, but he illogically brands the title Peak District as a "bastard phrase." There is nothing bastard about it whatever, and Professor Trevelyan and his colleagues responsible for the former of these two books are merely following time-honoured custom, the Ordnance Map, and correct usage in employing it. As a matter of fact there is no definite agreement among place-name philologists as to the real meaning of the original term "Peaclond" itself. The Pecsoetna, it is true, were the earliest known settlers of the Peak District, but it is not at all certain that this "Peak" had its modern significance of a pointed hill.

The book, with its excellent format, light weight, and clear print contains a large number of representative expeditions in the northern half of Derbyshire, with which the writer is thoroughly familiar. The chapter on mountaineering however is less satisfactory, and almost entirely overlooks the local pioneer work of Derbyshire men in that region. There is no map and no sort of index where such is almost indispensable. Some of the eight illustrations are quite excellent, particularly that of the Staffordshire Roaches, facing p. 120. The jaunty style pervading the book will no doubt appeal to its younger readers, but while personification of the chief features of the landscape is at times effective it can become wearisome when overdone.

"Hiking" is not an "American word," as reference to 'Wright's Dialect Dictionary' clearly shows, and it is odd that a writer with claims to a knowledge of geology should use "strata" and "stratas" as singular and plural forms respectively. In a book dealing almost wholly with the hills and dales of Derbyshire he will probably find few of the inhabitants of that region who will agree with his comment that "Dove Dale has been heavily overwritten." On the two recent occasions when the amenities of that incomparable stretch of characteristic natural beauty have been seriously threatened, it is those living in its immediate neighbourhood who have shown in a most practical way their sense of that beauty. Two of them, dwelling on the Derbyshire side of the Dale, have provided the £22,000 required to rescue it from desecration and to secure it for public enjoyment. W. W.

ISLE, BEN AND LOCH. By S. Heckstall Smith. *London: Edward Arnold & Co.* 1932. 9×5½ *inches;* 248 *pages; illustrations by the author, and maps.* 10*s* 6*d*

All possible permutations and combinations of these three words or their equivalents will soon be exhausted for titles of books on the west of Scotland. We have here however something of a departure from previous publications bearing such three-word labels in that the book is written primarily for yachtsmen by a yachtsman and—a more remarkable fact—not by a Scot. There are rambling accounts of two cruises, from the Clyde to Oban and from Oban to Skye, with enthusiastic descriptions of scenery and an almost Caledonian passion for bits of local history and pieces from the national bards. The author frequently breaks away from the main narrative to indulge in what he calls "Yarns and Interludes," the former not specially thrilling but the latter no doubt containing much practical information and sound advice for the amateur coasting sailor. Yachting is a subject on which he is really at home; geology, as he admits, is not, and his Professor friend should not have allowed him to state that the Liasic (*sic*)

rocks of Pabay are the oldest in Scotland. He needed no special scientific knowledge to save him from the futile observation that "if there had been no mountains, there would have been no Island of Mull; the mighty force of the great ocean would have washed it all away long ago." He must have seen many a time the low islands of Coll and Tiree lying outside Mull. His simple pen-and-ink sketches are not unpleasing, and he does not unduly exaggerate the fantastic outlines of the Sgurr of Eigg and the Old Man of Storr. J. H. R.

A WAYFARER IN DENMARK. By GEORG BRÖCHNER. *London: Methuen & Co.* 1932. $7\frac{1}{2} \times 5$ *inches;* xvi + 208 *pages; illustrations and map.* 7*s* 6*d*

Georg Bröchner leads the intelligent visitor with time to spare quietly and pleasantly through a land of sunshine, history, and modern comfort. It is a conducted tour, for he does not trouble us with fares and time-tables but wanders easily from Copenhagen, the city of many names, to the castles of Jutland and some of the little country towns and villages which are no less interesting. He describes buildings rather as an historian than an architect: a tower or a palace is for him the excuse to tell some story about its origin and the people who lived in it. It is a fair method of dealing with a country where the present is never allowed to obscure the past. The author succeeds in making the country appear attractive, but he leaves perhaps too little space to speak adequately of the hospitality and pleasant manners of the people who inhabit it. One may go to Denmark to see the land, but one returns to visit one's friends. For the traveller the book would make a good companion volume to an ordinary guide-book; it is of a new and intimate style, and its photographs are small but well produced. To the student it may appear somewhat unbalanced, for the author has dealt chiefly with whatever interested him most. But his style is pleasant, his incidents well told, and his description of Hans Andersen will appeal to every one who remembers the fairy stories. J. M. S.

THE ANCIENT BRIDGES OF MID AND EASTERN ENGLAND. By E. JERVOISE. Written on behalf of the Society for the Protection of Ancient Buildings. *Westminster: The Architectural Press* 1932. $7\frac{1}{2} \times 5$ *inches;* xii + 164 *pages; illustrations.* 5*s* 6*d*

This is the third of Mr. Jervoise's series of books on English bridges written for the Society for the Protection of Ancient Buildings, and deals with the counties of Beds, Bucks, Cambs., Derby, Essex, Herts, Hunts, Leicester, Lincs, Middlesex, Rutland, Staffs, Suffolk, and part of Warwickshire. The survey "is concerned primarily with the bridges which might be threatened by road-widening schemes." The interesting historical notes are largely culled from Records of Quarter Sessions now published for several counties. Some of the old bridges have been saved by the happy circumstance that a by-pass road has had to be constructed, as that at Wansford, picturesque but too narrow (14 feet) for even the reduced traffic. From the Duddington bridge over the Welland there is a charming view towards the mill and church. In this case one face, downstream, has unfortunately been disfigured by a widening (1919) in blue brick and stone. Wakerley bridge is a good example of mediaeval work (probably fourteenth century) with no history. Among those which are better documented are St. Neots, dating from 1254, St. Ives, with a chapel on the central pier, from 1259, and the Abbot's Bridge, Bury St. Edmunds, from ? 1230. Noteworthy are Huntingdon bridge, the finest mediaeval bridge in this part of England (pp. 98–101), and Essex bridge over the Trent, now showing fourteen arches (formerly forty-three, possibly including a causeway), with a span of 100 yards, each cut-water having a recess for foot-passengers, and the width between parapets being

only 4 feet. The Eastleach Martin clapper bridge and Bibury footbridge (illustrated opposite p. 157) are attractive and exceptional examples. These pages are a fascinating study which should appeal to all who have at heart the preservation of our mediaeval heritage. S. E. W.

THIS UNKNOWN ISLAND. By S. P. B. MAIS. *London: Putnam* 1932. $7\frac{1}{2} \times 5$ *inches;* xx+390 *pages; illustrations and sketch-maps.* 7*s* 6*d*

THE HIGH LANDS OF BRITAIN. By S. P. B. MAIS. *London: Richards* 1932. $7\frac{1}{2} \times 5$ *inches;* 320 *pages; illustrations.* 7*s* 6*d*

The first of these two books is a collection of broadcast talks which were given weekly in the first four months of 1932. They describe seventeen excursions made at high speed in a day or two in each previous week. In most cases of course the author had fuller qualifications than that to speak about the region he was describing; but he seems to have aroused dissatisfaction in some of his listeners who hastened to put him right in letters which he is honest and courageous enough to print with others more appreciative. One lady took exception to the title of the talks, "The Unknown Island," from which she assumed the subject to be some spot in the Pacific. She was indeed not without reason. It is high time that writers like Mr. Mais realized that England for the greater part is no longer "unknown." He says he has no wish to paint the lily and admits that Devon, Sussex, Kent, the Lake District, and the Trossachs need no praise of his; what makes him think that the Peak, Cornwall, North Wales, or indeed any of his districts require touching up from his palette? His first talk describing a visit to Haworth on a snowy New Year's eve is by far the best. But why does he not show all the places mentioned on the rather childish two-page sketch-map instead of spreading trees evenly over the whole area, moors and all?

The articles in 'The High Lands of Britain' appear to have been partly written to boost British railway and motor transport, and were not worth publishing in book form, especially in view of the other volume. Mr. Mais rushes about at still more breakneck speed. The Quantocks are dispatched in two pages, the Welsh Marches in five, and we are whirled backwards and forwards across Dorset till we are dizzy. In this book the Lake District is deemed to require notice and gets it with a foolish exaggeration of the cliff of Helvellyn; it would be a considerable achievement to roll the 762 feet from the summit to Red Tarn, and to talk of falling 2000 is ridiculous. It is probably part of a wholly unnecessary scheme to show the Briton how superior the attractions of his native land are to those of others, particularly of France. The second chapter entitled "Why Britain?" will antagonize many readers with its uncalled-for jibes at the French and their hotels. Apart from this jingoism this preaching is to the converted; the Briton *has* discovered Britain and already has guides enough to help him find it in detail, if indeed he wants a guide at every turn. Even Mr. Mais himself says of one of his regions: "That is one of the great charms of this . . . country. It leaves you to discover its secrets for yourself, and by so doing bestows on the discoverer a sense of real ownership." Those words are worth all the rest of the two books put together. J. H. R.

SOUTHERN EUROPE: a regional and economic geography of the Mediterranean Lands. By MARION I. NEWBIGIN. (Methuen's Advanced Geographies.) *London: Methuen & Co.* 1932. $9 \times 5\frac{1}{2}$ *inches;* xvi+428 *pages; diagrams and maps.* 15*s*

This study of the European Mediterranean Lands is the outcome of years of observational work in the field combined with a careful and critical examination of the widely scattered literature of the subject. Her previous writings have

shown the author's particular interest in the Mediterranean Region, and she is to be congratulated on a comprehensive contribution to our knowledge of a part of the world of which studies in English have hitherto been lacking. Some readers will no doubt feel that the bias on the physical side is rather marked in view of the subtitle of the book—'A Regional and Economic Geography of the Mediterranean Lands.' Economic statistics are however wisely omitted from the main text, and are presented in a summary and suggestive form at the end of each part, while the distribution of the various products is described in association with the cognate physical material, which is the fundamental background to all studies of the Mediterranean Region.

The author's gift for selecting and emphasizing crucial geographical facts is well known, and never has this power been more evident than in the concise introductions and conclusions which are a feature of each part of this book. Here she crystallizes in a few brilliant phrases the essence of the more detailed material. The elimination of those geomorphological details which do not affect either relief or economic development is very welcome, especially as it is accomplished, not by totally ignoring, but by omitting to develop the history of unimportant structural features. The treatment of Mediterranean climate is probably the soundest and certainly the most convincing yet published in English. The work is illustrated by many well-chosen diagrams, although it is possible that their very lucidity tends to encourage laziness in the reader. Dr. Newbigin has foreseen this criticism in her preface, and has stressed the need for using both atlas and large-scale maps in conjunction with her text.

In the opening chapter on Italy a regional grouping is introduced which is a striking departure from that commonly adopted. Liguria is shown to have closer economic connections with the Northern Plains than with Central Italy, and a number of reasons are developed for regarding this region as an "annex of the North rather than as an isolated part of the Centre." The lowland border of Istria, the Italian Quarnero Islands, and Zara are considered as a counterpart of Liguria and an homologous annex to the Alpine borderlands. The changes proceeding in Greece at the present time are fully treated, and it is shown that the stimulant afforded by the Balkan War settlement has resulted in a revival of agriculture, the traditional Greek industry. This account of the least fully known of the Mediterranean peninsulas is quite the most comprehensive and authoritative hitherto published in English.

The bibliographies are no mere list of references, but include critical notes on many authorities, while special attention is drawn to those which themselves have good bibliographies. Statistical publications whence economic data can be revised, and lists of maps up to a scale of 1/100,000, are quoted for each country. Dr. Newbigin writes for the student of systematic geography, and her work provides both a basis and a guide for a fuller examination of Mediterranean problems.

H. C. K. H.

LITTLE MISSIONS. By SEPTIMUS DESPENCER. *London: Edward Arnold & Co.* 1932. $7\frac{1}{2} \times 5$ *inches;* 216 *pages.* 6*s*

Mr. Despencer's very readable little book provides something more solid than its title and unassuming exterior promise. It begins in a vein of personal reminiscences of political missions in East Central Europe at the close of the war; but although this runs throughout it—there is a diverting account of adventures while bringing oil supplies from the Ukraine to Vienna—the more valuable portion is a series of brief but acute sketches of the post-war social state of these new countries. He gives most attention to the agrarian reforms and to the treatment of national minorities, and directs his severest criticisms against Poland

in these matters. The Romanian agrarian reform is said to have been "the most comprehensive, and the most beneficial," though its effect has been to decrease the quality and quantity of the wheat produced. But the author does not concentrate on such factors alone, since the stability of nations depends ultimately upon instincts which he considers are too often neglected by international financiers.

The author has evidently close acquaintance with the countries with which he deals, and writes with humour and refreshing vigour. His conclusions must be carefully weighed by students of present-day conditions in Eastern Europe.

G. R. C.

THE BALTIC REGION: a study in physical and human geography. By E. G. Woods. [Methuen's Advanced Geographies.] *London: Methuen & Co.* 1932. 9×5½ *inches;* xvi+434 *pages; illustrations and maps.* 18*s*

The subtitle of the work is rather misleading, since the author's interest lies far more in the physical than in the human geography of the Baltic Region. The book is divided into four parts, the first of which is entitled "General Account," and begins with a definition of the Baltic Region, followed by a very brief survey of the climate, an outline of the physiography, and a short section on the human history of the region as a whole. The second part, "The Province of Baltic Fennoscandia," covers two hundred pages, of which approximately half are devoted solely to an account of the geomorphology of the area, while the remainder describes a few regions in considerable detail, but still has a very large preponderance of geomorphological or physiographic detail, and gives scant treatment to the human aspects of the subject. These remarks are equally applicable to the other two parts, "The Dano-German Province" and "Province of South-East Baltic States." The regional chapters are written in a pleasant descriptive style, but do not go very deeply into the subject.

The illustrations are numerous and many are of value, but some seem rather pointless in a book published essentially for the advanced student of geography. Had the author included a profile of the Indalsälf amongst her illustrations of that river, the nature of the Swedish rivers would have been more clearly demonstrated, and the essentially similar, yet contrasted, profile of a Finnish river could have been clearly shown. The human development of both these areas is based on the rivers, either as a source of power or as a means of timber transport, and in both cases the numerous breaks of slope are of vital importance; a profile presents more concrete evidence of this than a descriptive traverse down the stream. The extensive bibliography should prove of value to the student of the geomorphology of the Baltic Region, but here again the human aspect receives little attention.

This book will interest mainly the traveller who desires a guide to the physical geography of the region, and the student of geomorphology: it still leaves room for an English regional geography of the Baltic Lands on lines which the French geographers have made familiar.

H. C. K. H.

A TRAVERS LE MASSIF CENTRAL: Ségalas, Levézou, Châtaigneraie. By André Meynier. *Aurillac: Editions U.S.H.A.* 1931. 10×6½ *inches;* xx+490 *pages; illustrations and sketch-maps.* 50 *fr*

The region dealt with in the above book is that which lies on the south-west flank of the Massif Central in France. It is defined by the rivers Cère and Aurillac in the north and stretches as far south as the Mountains of Lacaune. In the west its limits are those of the Plain, and in the east the Mountains of Aubrac. It is mainly the Department of Aveyron, but includes portions of the

neighbouring Departments. Châtaigneraie lies on the north-east and Levézou on the south-east, while the western section is divided into the Ségala du Quercy in the north, the Ségalas du Rovergue in the centre, and the Ségala Tarnais in the south. Ségala (from seigle=rye) is the name given to the wet bocage country in contrast to the dry limestone causses. In spite of varied topography and geology there is sufficient unity of morphology and rural economy to justify the acceptance of the region as a natural unit.

The book is divided into two main sections. Part I deals in detail with the geomorphology and climate of the area. It is especially interesting as the N.W.–S.E. Armorican folds here cross the S.W.–N.E. Variscan folds. Every page gives evidence of most careful work in the field. Part II deals with the human geography of the region, under many headings. The author traces the development of the rural life from the eighteenth century, when agriculture was the main occupation of the peasant and rye was his main food. Pastoral work was supplementary. The standard of life was very low. Later came crop-rotation and the potato. Then means of transport were improved and the railway followed. During the nineteenth century the use of fertilizers both natural and artificial led to a great improvement in the standard of farming. There follows a detailed discussion of the distribution of population and types of settlement leading to a study of industrialization in the area, which contains the coal basin of Décazeville.

The book is of great interest and value, written with all the care and clarity that we are accustomed to associate with regional studies of France. A. B.

ASIA

THE LAND OF TIMUR: recollections of Russian Turkestan. By A. POLOVTSOFF. *London: Methuen & Co.* 1932. 9×5½ *inches;* xii+206 *pages; illustrations* (by B. LITVINOFF) *and sketch-map.* 10*s* 6*d*

This is a pleasantly written sketch by an author of admitted qualifications, of phases of a bygone life in Russian Turkistan. The writer gives graceful expression to his experiences in an almost forgotten era, in that land of glamour and charm. His English is admirable. He flits from city to historic city, and from rich valley to cliff trail and to *pamir*, contriving always to throw fresh light on what in other hands might well have been dull. Nowhere does he permit himself to lapse into the merely instructional.

The book does not lay claim to any geographical significance, but the writer's description of his journeys to "Yazgoleem" and of the "ovrings" of the Western Pamir, or rather upper Oxus valleys, are of much interest, covering a country and peoples visited by very few non-Russian travellers, but with characteristic features not to be found elsewhere in the world. It is scarcely possible that any British traveller will in our generation tread the byways so pleasantly delineated by Polovtsoff, and this perhaps gives the work that special interest which attaches to a forbidden land, a land with a future as well as a past.

The monochrome wash drawings form a lively and entirely appropriate addition to the text. There is a rough but not inadequate sketch-map in the front end paper. L. V. S. B.

PERSIA. By Sir ARNOLD T. WILSON. (The Modern World. Edited by the Rt. Hon. H. A. L. FISHER.) *London: Ernest Benn* 1932. 8½×5½ *inches;* xvi +400 *pages.* 21*s*

The sheer mass and variety of the information which Sir Arnold has drawn from his vast store of knowledge and crammed into exactly four hundred pages cannot fail to impress the reader; but it is this same encyclopaedic quality which is at once the chief virtue and the chief fault of his book, since it is impossible for

the ordinary man to assimilate more than a limited quantity of facts at one sitting. For this reason the book makes perhaps rather dull reading, though for the student it is invaluable as a work of reference; packed with interesting facts on every page, it yet lacks that thread of coherence which makes a book impossible to put down.

For the rest the book is a monument of efficiency both as to scope and arrangement. Especially commendable is the inclusion of a brief bibliography at the end of each chapter which will be of enormous assistance in extending the reader's researches in any direction with the least possible expenditure of time and trouble. There are passages of real beauty, as well as of masterly lucidity, and throughout one is struck by the completeness of the knowledge and experience which must have gone to the compilation of this admirable treatise on the Persia of the present day. It is interesting, in the light of the Persian Government's recent action in annulling the Anglo-Persian Oil Company's concession, to read Sir Arnold on the subject of the granting of this same concession. He says (p. 90): "The concession was granted, after lengthy negotiations, on terms which do credit to the bargaining abilities of the Grand Vizier of the day, for . . . the conditions which include a royalty of 16 per cent. on the net profits compare from the point of view of Persia very favourably with those imposed by other Governments twenty years later when the importance of petroleum was fully appreciated."

There are fourteen chapters full of information on such diverse subjects as literature, irrigation, foreign relations, currency, and education, and some really beautiful descriptions of the country by one who knows and loves it. R. E. B.

THROUGH THE KARA SEA: through Arctic waters to the Yenesei River. By LEONARD MATTERS. *London: Skeffington & Son* 1932. 9½×6 *inches;* 284 *pages; illustrations and sketch-map.* 18*s*

Mr. Matters in the summer of 1931 made a voyage in a British tramp steamer round North Cape, through Barents Sea, and on past Novaya Zemlya and the Kara Sea to the great Yenisei River. His ship was one of those composing the "Kara Sea Expedition" which now every summer visits the bleak seaboards and estuaries of Northern Siberia; her destination was Igarka, some hundreds of miles up the river, and she was to load timber. Such is the journey described in the first third of the book—he leaves us to conclude that he got back safely—and it is well described, in a light-hearted narrative that makes excellent reading. He gives a vivid picture of the magnificence of the West Fjord, and an amusing one of the old skipper who always had to grumble at something; he interests us with details of how the Soviets are opening up a safer sea route to Siberia, their land of the future, and how for that purpose they maintain a highly organized ice vigil with wireless stations, planes, and ice-breakers. It is a pity that the introduction is rather silly and the map insufficient, also that the author soon shows that he is writing his first travel book by mentioning everybody by name and calling everything Arctic; and that he is a journalist by trying to make his wanderings sound adventurous and unique when they were not. Nevertheless, he is a good journalist, and his pages are packed with things which any one who has wandered in such remote regions must appreciate.

The other two-thirds of the book are of still more absorbing interest, for they describe the extraordinary "mushroom" town of Igarka (10,000 inhabitants) just north of the Arctic Circle, on the banks of the river where in 1928 there was not even a camp of the Samoyed (Nenzy) hunters, who were then almost the only inhabitants of those regions. It is an illuminating example of what Soviet effort can do, and these pages must be read by all who are interested in the great

developments that are undoubtedly taking place in Russia. Mr. Matters's stay was short, but he formed very favourable opinions about the workings of Communism in that far corner of Russia. If his tributes seem a little too glowing he always tries to be fair, and continually says he would like to know if conditions and the people are similar in the more important timber districts round the White Sea. They are; but some would be a little less hearty in praising them. N. V. P.

ḤADRAMAUT: some of its mysteries unveiled. By D. VAN DER MEULEN and H. VON WISSMANN. *Leyden: E. J. Brill* 1932. 9½×6 *inches;* xxvi+248 *pages; illustrations and maps*

This book is a journal of travel in the Hadhramaut, written by the Netherlands chargé d'affaires at Jidda, and supplemented by scientific, botanical, and geographical results compiled by his German friend and fellow-traveller Von Wissmann, the Yemen explorer. The route taken was from Mukalla through Ka'aiti territory, down Wadi Du'an to Wadi Hadhramaut, eastward to Shibam: thence through Al Kathir country, past Saiun and Tarim to Qabr Hud and Bir Barahut. Retracing its steps to Shibam the party regained Mukalla *via* Wadi 'Amd.

The occasion of the journey was "a mission entrusted to us by the Netherlands Government." The northward route, followed through Ka'aiti territory, traversed country familiar either in whole or in part to A. von Wrede (1843), Leo Hirsch and Theodore and Mrs. Bent (1893), W. H. Lee Warner (1918), and Colonel the Hon. T. M. Boscawen (1929). The eastward expedition (through Saiun, Tarim, on to Qabr Hud and Bir Barahut) represents courageous and, in the main, pioneer work, a remark especially applicable to the major part of the southward return journey *via* Wadi 'Amd, that unsettled western fringe of Hadhramaut, which Von Wrede had in part touched, and of which the Southern Portions, known as Wadi Hajr, had been examined and surveyed by O. H. Little (1925) at the instance of the late Sultan Ghalib of Mukalla.

Interest in Hadhramaut is threefold: geographical, archaeological, and political. Geographically, we gain two important results from the authors' journey. First, the magnificent general map of all Hadhramaut compiled by Von Wissmann (attached in a pocket at the end of the volume). This map will be an indispensable companion to any future traveller attracted by the romance of South Arabia. Second, the established details of Eastern Wadi Hadhramaut proper, and of the hitherto unknown topography of west-lying Wadi 'Amd and Wadi Yab'ath. Archaeologically, Van der Meulen and Von Wissmann solved only one mystery, that of Bir Barahut. Their meticulous examination of this "typical limestone cave, with nothing whatever volcanic about it," finally explodes the thousand-year-old myth that here was "a volcano which ejects coals as large as mountains" (El Mas'udi—A.D. 950—in his Kitab Muruj Edh Dhahab), and confirms Squadron-Leader Cochrane's verdict that the nearest volcano—an extinct one—is at least 50 miles away. Their report on Qabr Hud merely codifies the local accounts and supports the very clear details already obtained in a photograph by the R.A.F. reconnaissance. A short account is also given, accompanied by sketch-plans, of the ruins of Al Mukainun, of Husn Thoba, of the carved hunting-scenes on the sandstone capital detached from the wall at Husn el 'Urr, and of the Northern and Southern Buildings at Ghaibun (Al Mashhad in Wadi Du'an). All these are not without interest in themselves, but they add little, if anything, to the bare knowledge which we already have that the ancient Minaean, Sabaean, and Himyaritic kingdoms were continually at war with each other; that the arts of fortification and irrigation were skilfully practised; that Sin was the national god of the Hadhramis, 'Athtar of the Minaeans, and

Ilmaqa of Saba. The veil still hangs over the main mystery, the ancient route along Western Wadi Hadhramaut running from Shibam past Shabwa and its salt-mines right up to the Yemen past the massive works of Marib. Politically, the book is disappointing. In his naïve exaggeration of the dangers which beset his path Van der Meulen fails to increase our already complete knowledge of the petty political vendettas of the interior. He displays at times a perhaps unconscious but none the less regrettable anti-British bias when reporting the opinions of various Sada (or Sayyids) and commenting on the two rival Ruling Powers—the Al Ka'aiti who control the coast towns and the Wadi Du'an route to Shibam, and the Al Kathir sultans paramount in Eastern Wadi Hadhramaut and Tarim.

Despite the excellent photographs, the indifference of the English "translation"—a mechanical transcription of Dutch phrases—mars to a certain extent what is otherwise a pleasant and attractive *journal de voyage*. W. H. L. W.

THE IRON ROAD TO SAMARCAND. By MARGARET R. CRAIG-MCKERROW. *London: The De la More Press* 1932. 9×6 *inches;* x+144 *pages; illustrations and map.* 7*s* 6*d*

This volume should meet with the approval of the Soviet authorities. Beginning with a description of a stay in Moscow, it continues as an account of the first tour planned by Intourist, the Soviet Government Travel Bureau, in 1931, from Moscow through Old Turkistan by the Turkistan–Siberian Railway, which was opened to traffic in 1930. The conditions under which the tourists travelled are best described in the words of the book: "Our train of course was a train-de-luxe. We lived in it for eighteen days and travelled some seventy-five hundred kilometres through Russia and Middle Asia . . . the food was abundant and delicious." The conducted party consisted of 16 Americans, 2 Germans, 1 Englishman, 1 Scotchman, 2 Russians, and 3 naturalized American citizens, and one is told that only one passenger (a Russian by birth) brought back tales of injustice and complaint, which were at first believed, but found by the authoress (who was evidently not the one Englishwoman) when she grew to understand the language better to be the opposite of what she heard said to him. One is however tempted to wonder which heard correctly, the Russian-born or the foreigner, when one reads as near the end of the journey as Samarqand that almost the only means of communication shared by a Persian and the authoress were "both our half-dozen words of Russian and innumerable signs." The authoress had visited Russia previously, and she formed the opinion that the conditions of peasants and other poor persons were 100 per cent. better than when she was there before the war, and that in Turkistan the Soviet authorities "are bringing light and freedom into millions of darkened lives." In Turkistan however the passengers appear not to have slept one night off the train.

Many interesting facts are related, especially in view of the Russian push towards the East, and it is instructive to learn that Soviet clubs, centres of culture, and universities were found all along the line, and that there is an up-to-date aviation service to Turkistan. Tashkent is very modern and progressing; Fergana industrialized; Samarqand a mixture of freight cars, cranes, women club-members, tall minarets, mosques, and picturesque Eastern garb; while Bokhara, though full of tumbledown buildings, is the possessor of a good bust of Lenin in the public park.

The return journey from the Caspian by way of Tiflis and Kiev was "simply a means of getting back to Europe," and is quickly passed over.

The photographs are good, the most suggestive being that of a Mohammedan tomb with Kirghiz women standing in front and a huge bust of Lenin posed on the top. E. W. N.

KAMET CONQUERED. By F. S. SMYTHE. *London: Victor Gollancz* 1932. $9\frac{1}{2} \times 6$ *inches;* xvi + 420 *pages; illustrations and map.* 16*s*

Mr. Smythe, having successfully ascended the Jonsong Peak of 24,400 feet as a member of Professor Dyhrenfurth's expedition in 1930, decided to climb a peak of over 25,000 feet in the following year. The most accessible and best-explored victim was Kamet, 25,447 feet, on the Tibetan frontier of British Garhwal. The author gives (p. 27) a list of ten previous reconnaissances or attempts. In 1913 Mr. C. F. Meade climbed to within 2000 feet of the top from his camp on the great saddle between the east and west peaks, an achievement repeated in 1920 by those lamented pioneers Kellas and Morshead, whose map is reproduced in the present volume.

Mr. Smythe's success was complete, five British and two Indian members of the party accomplishing the ascent of this the first summit of over 25,000 feet ever climbed. The account of this great ascent will interest all mountaineers, and perhaps not least those about to attack Mount Everest once more. But the latter will surely regret the loss of the services of the redoubtable Lewa, through the crippling of his feet by frostbite. Lewa appears to have carried up the film camera when (p. 201) Nima Dorje broke down; Lewa himself breaks down soon after leaving the summit (p. 208), and Mr. Smythe takes on the load, but is unable to carry it down to camp (pp. 209, 212). It was a graceful act of the party to insist that Lewa should be the first to tread the actual summit, but a pity to mar this compliment by unfeeling remarks and ungenerous comparisons as on p. 235, when the author meets the cripple on the way to hospital. His attitude towards the inhabitants of the country in which he was so fortunate as to travel leaves much to be desired; his reference (p. 239) to the schoolmaster and to the headman of Gamsali would have been much better omitted; his attitude towards the pilgrims of Badrinath is unsympathetic; picturesque Garhwali villages always consist of "filthy hovels" (pp. 53, 60, etc.). But the author is no kinder to Nature, with her "stench of rotting undergrowth," and valleys whose "foetid airs reek of disease and death" (p. 257); the rivers are "mud-fouled," and even night itself "scavenges" the mists from the sky (p. 281). There is a visible straining after effect, and the style is often laboured. May one ask how "the hardened mountaineer" can "shudder on the threshold of his imagination" (p. 282)? Mr. Smythe is a very celebrated mountaineer, but small errors indicate that as a traveller he is not at home in the East: thus it should be Ooryas and not Burmans who "suspend themselves in mid air from meat hooks"; according to Dr. Longstaff (*Geogr. J.*, vol. 31, p. 361) the Rawals of Badrinath are Namburi brahmans from Malabar, not Madrasis; the mahseer is not a salmon, but a carp; the author's spring onions are surely the well-known wild garlic. One suspects that the eagles are vultures, and that some at least of the *deodars* are *Pinus longifolia;* while native sugar is not *goa* but *gur*.

But in spite of various shortcomings this book will hold its place in Himalayan and mountaineering annals. No other expedition has approached the record of twelve new peaks in a single season (p. 378). The exploration of the water-parting between the upper Mana valley and the glaciers of Gangotri is particularly valuable, and will render the task of the complete survey of these glaciers from the Gangotri side, a task so unaccountably neglected by mountaineers, far simpler than it was before. It is much to be hoped that a better map (p. 280) will be forthcoming. Captain E. St. J. Birnie is to be congratulated on his skill in organizing the transport and supply for such a large party over so much difficult and poor country. Dr. Raymond Greene's chapter on the "Medical Aspects of High Climbing" is a valuable contribution to the subject, while Mr. R. L. Holdsworth writes enthusiastically on the flowers. The book

is lavishly illustrated with very beautiful photographs. The index is unusually full.

It is satisfactory to know that four members of this party (Messrs. Smythe, Birnie, Greene, and Shipton) will take part in the forthcoming attempt on Mount Everest. May they have the like success!

NORTH AMERICA

THE INDIANS OF CANADA. By DIAMOND JENNESS. (Department of Mines, National Museum of Canada: Bulletin 65.) *Ottawa* 1932. 10×6½ *inches;* x+446 *pages; illustrations and maps*

Some fifteen years ago the late James White brought out in a separate edition that portion of F. W. Hodges's Handbook on the Indians of North America which related to those of Canada. The staff of the National Museum at Ottawa has now issued the results of their own more recent researches on this same subject. Thanks not only to the labours of Mr. Jenness himself but also to his expert colleagues such as C. M. Barbeau, W. J. Wintemberg, F. W. Waugh, Harlan I. Smith, and others, Mr. Jenness has been able to give a most readable account of the Indian tribes of the whole Dominion. The reader will appreciate especially the excellent illustrations and above all the photographs taken for the most part by these same experts. That, for example, of a Chukchee canoe approaching Little Diomede island (p. 244) was a most fortunate shot. The description of the probable migration of the Indians from Asia *via* Alaska seems in every way clear and readable. Colonel J. K. Cornwall of Edmonton, a hunter and trapper who speaks the Cree language, related to the reviewer how during the Great War when encamped with some of his Cree Indians near a compound of Chinese coolies, one of the latter one evening broke out into a song which a Cree who listened to it informed Colonel Cornwall he could follow. Mr. Jenness himself has no doubt of the Asiatic origin of the North American Indians, and his illustrations on pp. 234 and 244 afford further proof of the correctness of this theory.

The field covered in this volume is extensive, embracing not only all the Indian tribes of Canada but also the Eskimo. The description of the manners and customs of the latter is full and the illustrations excellent. Although the maps both in the pocket and on p. 406 allot the whole of the coast of Labrador to these people, it should be mentioned that when Gaspar Corte-Real sailed southwards along it in 1501, the natives he seized were not Eskimos but Naskapis, as Hind has made clear.

Although Mr. Wintemberg has found Iroquois remains as far east as Kegashka, it is by no means correct to state that the two Indians carried off by Cartier in 1534 from Gaspé Bay formed part of "a mere scouting expedition" (p. 224). We are distinctly told that they had come down from Stadacona to fish; they may have known of the existence of fishing grounds from their former residence in those parts. One cannot understand the statement that "the affiliations of Cartier's Hochelagans are still unsettled" (p. 288) after the researches of Dawson, Wilson, Horatio Hale, and others, unless the people of Stadacona were of a different race from those of Hochelaga. Champlain's expedition of 1609 against the Iroquois did not consist merely of Montagnais (p. 126), but was accompanied also by some Algonkins and Hurons. It is surely incorrect to describe the village he and his Huron allies attacked in 1615 as belonging to the Senecas (p. 291); all the evidence available as well as Mr. Jenness's own map on p. 290 clearly goes to show that it belonged to the Onondaga tribe. The reader would have been

helped had an explanation been given of the meaning of the letters on the other two plates taken from Champlain's volume published in 1619. While it seems clear that three of the costumes on the plate on p. 275 were those of Algonkins, the fourth, he tells us, was the winter costume of a Huron (Champlain's Works, III, 132).

A very great deal of information will be found dealing with the Indians of the Plains as well as of the Pacific coast, most of which will be quite new to the ordinary reader. The bibliography is disappointing. Not only are many works, such as those of Long, Hill-Tout, Clarke, and Perrot omitted because they have not been mentioned in the text, but some titles are carelessly given. Dr. Ganong's initials are not W. J., and Laverdière's edition of Champlain's works is entitled 'Oeuvres,' not 'Les Voyages de Champlain.' The authority given to Lafitau is surprising; hitherto he has been held to be not very reliable (p. 38, note).

On the whole however these seem very minor slips in a work of such importance wherein has been resumed the labours of many years of one of the most painstaking body of experts the Dominion of Canada possesses. It is a volume that does credit to the National Museum and has been written by Mr. Jenness in a clear and readable manner. H. P. B.

CENTRAL AND SOUTH AMERICA

VESTIGIOS DE LA ATLÁNTIDA. By RAFAEL REQUENA. *Caracas: Tipografia Americana* 1932. 9×6½ *inches; 328 pages; illustrations and map*

Dr. Requena made fresh excavations in the autumn of 1930 on the site Los Cerritos, near a former shore-line of Lake Tacarigua (the Lake of Valencia) in Western Venezuela. The secondary urn-burials found there, already known to English readers, through Joyce, from the work of Marcano, seem from his report to indicate extensive occupation by peoples, lake-dwellers and others, of more than one race and stage of culture; the highly sophisticated culture reached at some periods is well illustrated by the photographs of artefacts here published. With the object, doubtless, of widening the horizon of the Venezuelan public, the finds are interpreted throughout as "vestiges" of the civilization of Atlantis, the story of which is given at length in the first four chapters. R. A.

AUSTRALASIA AND PACIFIC

AUSTRALIA, NEW ZEALAND AND THE PACIFIC ISLANDS. By members of the Publications Sub-Committee of the Standing Committee for Geography in Public Schools. Edited by E. D. LABORDE. *London: William Heinemann* 1932. 8½×5½ *inches;* x+278 *pages; diagrams and maps.* 7*s* 6*d*

The authors of this school text-book have allowed themselves sufficient space to treat Australia, New Zealand, and the Pacific on generous lines and to introduce various interesting topics, such, for example, as the history of discovery and exploration and accounts of the political and social life, which are usually crowded out of books of this type. In the allotment of space however New Zealand, which gets only fifty pages, comes off rather badly compared with the Pacific Islands, which get about seventy. Of the three main sections of the book, in fact, that on New Zealand rather lacks graphic quality and interest, while that on the Pacific Islands is an admirable survey of those clusters which (the East Indies excepted) are usually as far remote from school consciousness as they are physically from the trodden ways of mankind.

In general tone and selection of matter the book is in keeping with its predecessors issued by the same committee of authors. It is based on a broad cultural outlook and it accordingly puts economic geography in a proper place among other subjects of human interest. On the whole it avoids summary statements of fact without causal evidence, and it attempts (more by quotation than by original descriptive matter) to conjure up pictures of the landscapes. Written by experienced teachers and planned as something much above a mere cram-book, it should prove valuable for the work of senior Forms and for the information of the general reader. But it gives a faint impression of having been somewhat hastily compiled: loose sentences occur occasionally; and there are some slips, as on p. 184, where capital borrowings are spoken of as invisible *im*ports, and on p. 193, where "peninsula" is used for "isthmus." The maps and diagrams are not very complete in design, nor do they in every case embody the most up-to-date material available.

Perfect school text-books are ideals almost impossible of attainment, at all events in the more advanced kind; since to write them the authors would require to have both the ripe experience in teaching problems of busy schoolmasters, and the learning of University professors. Yet both these qualities are present in no small measure in the book under review, which provides in a form that is readily comprehended a store of useful material gathered from many authorities.

E. W. S.

POLAR REGIONS

KLENGENBERG OF THE ARCTIC: an autobiography. Edited by Tom MacInnes. *London: Jonathan Cape* 1932. 8 × 5½ *inches;* 360 *pages; illustrations.* 10*s* 6*d*

Few names in Arctic Canada have provoked such prolific comment as Kristian Klengenberg, the "square-head" free-trader of the Western Arctic who died in Vancouver before the last chapter of this book was completed. A byword in the barracks of the Canadian Mounted Police, a thorn in the flesh of the Hudson's Bay Company, *persona ingrata* to the missionaries, this man of rugged character here tells his life-story of adventure. For pertinent reasons we (and the Mounted Police) are perhaps not taken into his full confidence in one or two instances.

At an early age the author voyaged as a member of the crew of a Yankee whaler to the Behring Sea and the waters of the Western Arctic. Seizing the first opportunity he returned with the whalers and wintered among the Eskimo. Attracted by the life of the North, he married an Eskimo girl that winter, and for thirty-three years he roved the North lands—"floor whaling" on the pack-ice in the early days when prices were good, trapping, and finally establishing a chain of trading posts. His fortunes were never stable: one year found him living in plenty, the next he was hard put to it to keep his wife and family from starvation. Born and bred a sailor he accomplished with impunity many hazardous voyages in his schooners to Victoria Island and the Coronation Gulf. More than once his life was in jeopardy at the hands of a mutinous crew, but it was not Klengenberg's habit to give the best of the bargain to those who crossed his path.

Very little has been written of the everyday life of the Western Arctic, and the book, apart from the inherent interest attaching to an unusually vivid biography, yields in its casual narrative many facts of interest alike to the geographer and the ethnologist. The publisher has failed to provide a map to which the reader is entitled.

G. B.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

BEITRAG ZUR MITSCHWINGUNGSTHEORIE der relativen Pendelmessungen mit 2- und 4-Pendelapparaten. By EINAR ANDERSEN. *Copenhagen: Bianco Lunos Bogtrykkeri A/S* 1932. 10×7 *inches;* 96 *pages*

This paper discusses the corrections to be applied to the time of swing of a pendulum used for relative gravity measurements, to avoid errors due to lack of rigidity of the support. The main results and the method by which they are obtained are not new, but the discussion of the limits within which the formulae are valid is much more thorough than in former work. The elimination of the effects of sway of the support by swinging two pendulums in opposite phase is investigated in detail. Expressions for the effect of not fulfilling the correct initial conditions exactly are obtained, including the effect on the fictitious pendulum of Vening Meinesz. The paper forms a convenient summary of the work of the last forty years on the subject. The mathematics is given in the rather tedious detail which is usual in degree dissertations. E. C. B.

ECONOMIC AND HISTORICAL GEOGRAPHY

CHRISTOPHER COLUMBUS. Documents and Proofs of his Genoese origin. English–German Edition [Published for the City of Genoa at] *Bergamo: Istituto Italiano d'Arti Grafiche* 1932. 15½×11½ *inches;* xxiv+288 *pages; illustrations and facsimile map.* £5 4*s* 6*d*

Columbus, in these latter days, has paid dearly for the artistry with which he matched his career with a hypothetical seafaring boyhood and naval forbears. The exposure of his fallibility has led some critics to treat his personality almost as a myth: Columbus was a Catalan, they say, Columbus was a Jew—anything rather than the simple *vir Ligur*, the woolworker's son of Genoa.

In vindication therefore of his name, and of the right to claim the honour of being his birthplace, the City of Genoa has set forth a magnificent volume containing in facsimile all the documents on which their overwhelming case rests. Three editions have been issued simultaneously, the original Italian, the English-German, and the French-Spanish. Each document is translated and annotated, and a scholarly introduction allows of an appreciation of the different types of evidence adduced.

No more splendid monument has been raised to Columbus's memory than this collection, which will delight both the specialist and the amateur. Professor Monleone, the editor, and his colleague, Dr. Pessagno, are to be congratulated on the painstaking labours with which they have restored the truth concerning Italy's greatest son. E. G. R. T.

ECONOMICS IN PRIMITIVE COMMUNITIES. By RICHARD THURNWALD. *Oxford: University Press, for the International Institute of African Languages and Cultures* 1932. 9×6 *inches;* xiv+314 *pages; illustrations.* 25*s*

Sociologists will welcome this critical study of the economics of primitive communities. The essential difficulties of such a study are two: first, the bewildering variety of material from all ages and all continents must not be manipulated to fit a favourite hypothesis; secondly, as life is short and field work in anthropology long, even so distinguished a field-worker as Professor Thurnwald must largely depend on the observations of others. But the reports of travellers may suffer from the illusions of common sense, the work of trained anthropologists from the subtle distortions caused by a cherished theory. Only so experienced a scholar

as Professor Thurnwald could allow for the possible error in works so varied as his bibliography contains.

He is however concerned, not so much to give the actual history and working of particular communities as to disentangle the necessary conditions of economic change. "If," he says, "we are ready to regard the fundamentals of primitive economics with a balanced and realistic mind we are struck by the fact that we see the same emotional powers at work as with us, only sometimes in different proportions." Professor Thurnwald does not make it quite clear what he understands by economics. He is guided by the facts that many communities show every sign of a long-continued stability; that technical changes do occur, *e.g.* the digging stick is superseded by the hoe, and the hoe by the plough; and that there have been differentiations of social structure, *e.g.* the homogeneous communities of man as hunters and trappers have given place to stratified cattle breeders and traders.

The essential problem is to discover to what conditions the technical changes were due, and the nature of the interaction between the technical and the structural change. It is impossible here to follow the subtlety and skill with which Professor Thurnwald discusses such problems as the original development of cattle-keeping from hunting; the emergence of the idea of labour ("hunting and pastoral tribes are not workers"); and the emergence of slavery. The fallacy of conceiving cultural development as taking place along one line only or easy hypotheses as to the origin of inventions or the part played by cultural contacts will not survive the carefully documented material Professor Thurnwald has collected. But a single page (p. 15) is barely sufficient to discuss the factors that influence the increase and decrease of population, and in his discussion of wages, value, and capital, Professor Thurnwald is himself confused by a definition of economic man as obsolete in economic theory as Herbert Spencer in sociology.

It may perhaps be noted that in the works of Henry Maine and Walter Bagehot many of the theories of cultural development and economic organization Professor Thurnwald here slays were even in the nineteenth century severely wounded.

F. V. S. S.

IRRIGATION PRINCIPLES AND PRACTICES. By ORSON W. ISRAELSEN. (Wiley Agricultural Engineering Series. Edited by J. BROWNLEE DAVIDSON.) *New York: John Wiley & Sons; London: Chapman and Hall* 1932. 9×5½ *inches;* xiv+422 *pages; illustrations and maps.* 31*s*

Although the title does not indicate it, this volume is strictly limited to the conditions and practices prevailing in the portion of the United States lying to the west of the 100th meridian of western longitude and consisting chiefly of the States of Idaho, Wyoming, Nevada, Utah, Colorado, California, and New Mexico, in which an aggregation of some twenty million acres of irrigated land is devoted to general farming, including grazing and the production of crops of fodder, and to arboriculture. There is no attempt at any comprehensive survey of the wider aspects of irrigation work, exemplified in the monumental undertakings in Egypt and the Sudan and in North-Western India nor of the vast fields of enterprise available in the desert tracts of Australia, Arabia, and 'Iraq, and Southern Africa. The great dams and barrages of the Nile and the extensive canal systems of the Punjab and Sind receive no mention. The only reference to external procedure is contained in three or four photographs of primitive water-raising appliances (the Natali, or swinging basket, the Shaduf and the Sakiyeh) characteristic of Oriental countries, and these are reproduced from a bulletin published by the United States Department of Agriculture. All the sources of reference, in fact, are American, and the bibliographies at the end of

each chapter contain no titles of distinctively European works on the subject. It is perhaps a permissible commentary to quote the statement that of approximately two hundred million acres of irrigated land in the world, Asia possesses nearly three-fourths, and North America, including Canada, only slightly more than one-eighth.

The book has evolved from the author's lectures to his students at Utah State Agricultural College, where he is Professor of Irrigation and Drainage. Within its limitations it gives a very useful and well-illustrated account of irrigation methods on the farm, the meadow, and the orchard. Some introductory matter includes the theoretical principles of hydraulic flow, in his statement of which the author favours the use of Manning's formula. The book goes on to discuss pumps and pumping appliances, illustrated by examples of North American manufacture, with some data on the cost of pumping operations. Various systems of irrigation are described and the processes of economic distribution of water are discussed with special reference to the cultivation of cereals, of alfalfa, of sugar beet and potatoes, and of orchards. Covering a good deal of ground, the author includes a notice of the social aspects of irrigation communities, and some of his observations thereon seem rather outside the scope of a technical work. Apart however from a little discursiveness in places, he adheres well to his main subject and he has produced a manual which should be of considerable service to students, in addition to affording guidance to the farmer and varied information for the general reader. It is interesting to note that there still remain some thirty to fifty million acres of land in the United States suitable for the application of irrigation methods.

The book includes an Appendix containing a series of problems and questions with numerical answers. B. C.

GENERAL

THE COUNTRIES OF THE WORLD. By A. MORLEY DELL. (Harrap's New Geographical Series. General Editor: R. N. RUDMOSE BROWN.) *London: George G. Harrap & Co.* 1932. $7\frac{1}{2} \times 5$ *inches;* 718 *pages; illustrations and maps.* 6*s*

This is quite a useful text-book at a moderate price, which aims at presenting a general view of world geography to pupils at the school certificate stage. There are numerous illustrations, usually well chosen, but in some cases there seems to be little point in including them in a book intended to be read in conjunction with a good atlas (*e.g.* the Rivers of Asia, Fig. 266). Some of them are too much reduced to be of any value (*e.g.* Fig. 25, a Relief Map of Europe; Fig. 112 and Fig. 179). There are many small points which call for criticism. The Nile Valley map (p. 507) would be of far greater value if the source were shown. Dudley (p. 152) no longer makes nails, nor (p. 153) is Buxton a centre for brewing. Careful revision for a second edition would eliminate many obvious errors of this type, which somewhat mar an otherwise useful book. A. B.

A YELLOW ADMIRAL REMEMBERS. By Vice-Admiral HUMPHREY HUGH SMITH. *London: Edward Arnold & Co.* 1932. $9 \times 5\frac{1}{2}$ *inches;* 360 *pages; illustrations.* 12*s* 6*d*

Admiral Hugh Smith joined the *Britannia* in 1889 and his recollections start at a time when the Navy was rapidly expanding. Masts and sails were dying, but they were dying very hard, and he gives us a most life-like picture of the period when the change was being made from masted to mastless ships. In the chronicle of his adventures and activities we are shown the evolution of the Navy, dropping

many of its old habits and customs as it worked up to the intense activity preceding the War.

As a captain, Admiral Smith had the command of ships in the Tenth Cruiser Squadron in the Northern Patrol and of two aircraft carriers. In 1926 "I became a Yellow Admiral, as in the Navy talk of the eighteenth century they used to call an admiral who was placed on the retired list without ever hoisting his flag. Even now, when I am sailing about in the Solent, if I pass close to a man-of-war when she is anchoring, hear the rattle of her cables and see the dust from her cable-lockers rising in the air like clouds of rust-coloured smoke, I feel my heart ache with a longing to be back on the forecastle."

The book makes excellent reading, and is full of good stories illuminated with shrewd comment. A. D. L.

YOUTH LOOKS AT THE WORLD. By BASIL A. FLETCHER. *London: Methuen & Co.* 1932. $7\frac{1}{2} \times 5$ *inches;* xiv + 250 *pages; illustrations and sketch-map.* 7*s* 6*d*

This book is a short account of a journey round the world by an Albert Kahn Fellow. The Fellowship is a very remarkable one. Founded by M. Albert Kahn, and still happily to a large extent directed by the founder, the Fellowship is intended to increase the number of men who have personal contacts with civilizations other than their own. The holder must spend a year travelling, he must go round the world, and he must visit certain specified countries, including European countries, Egypt, India, Java, China, Japan, and the United States. Within these limits he is given ample latitude, and the Fellowship is sufficiently valuable to enable the traveller to go more or less where he will without worry. By an extremely wise provision he is given absolute freedom in his occupations, but he may not engage in any specific study. It would be entirely alien to the spirit of the Fellowship for the holder to go round the world studying willows or bumble bees or engaging in any other specialized pursuit however meritorious in itself such a pursuit might be. The holder must be sufficiently old to benefit by such an extended period of travel, and sufficiently young not to be set in his opinions. The value of such a Fellowship to geographical studies can hardly be overestimated. Except in the case of very exceptional personalities it is more than probable that the actual report of the Fellows can hardly represent more than a superficial and hasty survey of immense problems. The purpose of the founder however was not to produce solid blue-books on international affairs, but rather to provide for a limited and fortunate few that type of training possessed by the mediaeval scholar who wandered from *studium generale* to *studium generale;* in this case the narrow academic round is taken from the lecture-room to the market-place. We greatly regret to learn that financial stringency has caused a temporary suspension of the Fellowships, and hope that they may not be permanently lost to geography and to the cause of international understanding and co-operation; for such a study provides the best possible introduction to what Professor Kenneth Mason in his inaugural lecture has termed the geography of current affairs.

There are few of such affairs that Mr. Fletcher did not find himself faced with in his journey. Education in Germany, the chaos of eastern Europe, and the League of Nations in session met him in Europe. In Asia the administration of Palestine, India, Java, China and Manchuria, Japan industrial and conservative —all these problems were seen, not through the pages of a newspaper but on the spot. He mentions, and clearly discussed on the spot, the great problems of the Pacific, and most appropriately he drove a car across the North American continent. Naturally such wide aspects of human geography can hardly be dealt

with satisfactorily within so brief a compass. Mr. Fletcher has however very wisely made a very miscellaneous set of problems into a single unity by giving for the most part what he saw or what he heard people say. Occasionally one could have wished he had seen a little more. There were no excavators at Ur, so he contented himself with what he had seen at the Baghdad Museum. Surely he might have looked at the ziggurat, even without a guide. If one merely wants to see specimens, after all, what is wrong with London? But such details are unimportant. The crux of the matter is that here is a Fellowship whose importance is difficult to overestimate, and in this book a most readable account of what the last Fellow saw in his journey round the world. Your reviewer is only too conscious of the things he himself failed to see during his similar journey. L. H. D. B.

THE MAN WHO WENT ON BUSINESS. By NORMAN TIPTAFT. *Birmingham: Tiptaft* 1932. $7\frac{1}{2} \times 5$ *inches;* x+148 *pages.* 5*s*

Ostensibly the record of a business trip round the world *via* the British Empire, this little book is actually an impassioned call to the men of England to organize and rescue their Empire before it finally disintegrates. The writer seems to envisage, though not too hopefully, a vast army, purged of all parasites, in which category he includes professional politicians, about seventy-five per cent. of officials, stockbrokers, most lawyers, commission agents, the idle rich; and consisting of manufacturers, managers, workers, travellers, massed in serried ranks, officered by the most able business experts, led by a strong dictator (business man), and solidly united in the fixed determination to reconquer all the world markets England has lost, and even create new ones. Presumably it is to forward the realization of this dream that the writer distributes through the relation of incidents and experiences of travel much rating of business men, candid criticism of the various Governments coming within his purview, and a lusty pounding of all politicians, home and colonial, white and coloured. His language is forceful and free; he is entirely in earnest and, though his predilections obtrude, his arguments and fulminations are usually thoughtful and sound. Readers of the book, who should be many, will find in it amusement as well as much profitable information. W. A. G.

LA GÉOLOGIE ET LES MINES DE LA FRANCE D'OUTREMER. Recueil de conférences organisées au Muséum par les soins du Bureau d'Etudes géologiques et minières coloniales. *Paris: Société d'Editions Géographiques* 1932. $10 \times 6\frac{1}{2}$ *inches;* viii+604 *pages; maps.* 60 *fr*

This work deals essentially with the French colonies from the geological and more particularly the stratigraphical standpoint. M. Georges Teissier contributes an Introduction and each section is written by a specialist. A geographical summary describes the position, climate, drainage, etc., and is supplemented by an outline of the tectonics. These histories of structure are illustrated by excellent geological maps, of which that of the north-west quadrant of Africa may be mentioned as an example; as compared with Hubert's map of 1919 it is brought up to date by several important corrections, and together with those of Tongking, New Caledonia, etc., forms a series of invaluable sheets. M. Lacroix deals with Madagascar, taking the crystalline rocks and their economic minerals, and M. Blondel the sediments of the west coast and the associated products. M. Dubertret describes the French Mandatory Area of the Levant, accompanying his account by a topographical sketch-map, for, as he remarks, little was known of the geology until recently, and the coast region alone had been surveyed. Nevertheless a useful summary of the geology is given as well as information regarding geography and water-supply, and the whole may advantageously be

read with the account of oil in 'Iraq as summarized by Bertrand, who deals with the indications of petroleum and possibilities of production in the French possessions. This chapter, forming one-fifth of the volume, is worth careful reading: the author prefaces his exposition by a synopsis of the characteristics of petroleum, its geological distribution and origin, and the structures common to the large fields of North America. Having thus paved the way, M. Bertrand deals with the petroleum possibilities of 'Iraq before touching on those of Syria and the Colonies. By agreement, France receives a quarter of the oil produced by the 'Iraq Petroleum Co., and, by way of gauging values, the author compares the geological structure on the left bank of the Tigris with that of the American fields on the edge of the Canadian shield and finds a strong similarity, though the beds involved are of very different ages. He thinks well of 'Iraq as a future oil field, believing the share due to France her only certainty of an important source of supply; although, after reviewing the Colonies one by one, he concludes that the structure of Equatorial Africa, Madagascar, and New Caledonia justifies detailed research for oil-bearing deposits.

The accounts of the minerals produced by each colony are of necessity summaries, the phosphates of Algeria and Tunis being more fully considered than the majority, and together, excluding oil, occupy about 120 pages of the book. Mineral production is given for the years 1928–30 inclusive, and each section includes a short bibliography. Two indices and a useful table of contents concludes a volume which will prove invaluable to those interested in the subject, and even such unfrequented parts of the world as the New Hebrides and Wallis Isles, Clipperton, and the Archipelago of Kerguelen receive a few lines of description. J. P.

THE WORLD-WIDE GEOGRAPHIES. By JASPER H. STEMBRIDGE. *Oxford: University Press* (1932). Book VI. Africa, Asia, and Australia. 8×6 *inches;* 304 *pages; illustrations and maps.* 3*s*

This is an excellent geography text-book for pupils aged twelve to thirteen or rather older. The aim of the author is to combine the physical and human sides of geography, and he has done so in an altogether delightful fashion. There are numerous illustrations, maps, and diagrams, each chosen with care and clearly reproduced. Three continents are dealt with in a manner both interesting and accurate. Its price is low and it is one of the most satisfactory books of its kind that the reviewer has yet read. A. B.

THE PHYSICAL BASIS OF GEOGRAPHY. By V. F. SEARSON. (Harrap's New Geographical Series.) *London: George G. Harrap & Co.* 1932. 7½×5 *inches;* 260 *pages; illustrations and sketch-maps.* 3*s*

This elementary book sets out very clearly the main physical factors underlying geography which every child should know. It is clearly printed, well illustrated, and simply expressed. There are numerous questions at the end of each of the twenty-three chapters. The reviewer feels that tides might well have been omitted at this stage—the middle forms of secondary schools. Many experiments on temperature, pressure, and moisture are clearly described and explained; some are unnecessarily simple and would be waste of time to do, but most are easily within the scope of a class able to handle simple laboratory apparatus. An irritating method of exposition is the interpolation of a question in the reading matter, immediately followed by the answer. A useful book for teaching the elementary facts of physical geography. A. B.

THE MONTHLY RECORD

THE SUBSIDENCE OF LONDON

Ordnance Survey Professional Paper No. 14, on "The Subsidence of London," was read at the York meeting of the British Association, when its title afforded sensational headlines in the daily press, the more so since the subsidence in question is most marked at the Bank of England. Before considering London in particular the author discusses the question whether any general downward tilting of south-east England is in progress. There are considerable differences between the original levelling from the Liverpool datum and that from Newlyn completed in 1921. Plate I is a map of England showing lines of equal difference, reaching a maximum of 2 feet in the downward direction in Essex. The discrepancy might be due either to a tilting of the land or to a cumulative error in the first levelling. From a consideration of what is known as to changes of level since Neolithic and Roman times and of mean sea-level at Felixstowe during the last fifteen years, it is concluded that the former cause is responsible for about 1 foot per century out of a total of 3·3 feet.

Plates III to VIII show the results of levelling along a number of lines through London. The levels of 1931 are taken as a datum and the differences from those of 1912, 1895, and 1865 are plotted, on the assumption that the points at the extremities of the line in each case have not moved relatively to one another. The results are remarkably consistent in showing a definite subsidence, practically confined however to areas situated on the river gravels and alluvium, subsidence on the London clay being negligible. The greatest subsidence, over 1 foot between 1865 and 1931, is at the Bank of England, at the crossing of the "buried" Wallbrook, and it is pointed out in the text that the graphs show maxima wherever other buried streams, the Westbourne, Tyeburn, and Fleet, and to a less extent the existing rivers Wandle, Ravensbourne, Lea, and Roding are crossed. These crossings and the geological boundaries are indicated on the graphs, the data being apparently taken from the 6-inch maps of the Geological Survey.

While the main object of the paper is to state facts rather than to account for them, one cause which readily suggests itself is usefully illustrated. Water draining through deposits of sand and gravel removes a proportion of the finer solid material in suspension, and thus leads to a lowering of the surface. Very little water now enters the gravels of London. Plates IX, X, and XI are taken from the 25-inch plans of the Hatton Garden, Covent Garden, and Leadenhall districts, and show the relatively minute areas on which rain is not prevented from entering the soil by an impervious cover of buildings, pavements, asphalt, etc.

An important point in connection with the "buried valleys" may be mentioned. On the geological maps it was found impossible to indicate the "made ground" except by notes. This artificial material is thickest in these valleys, and it seems probable that its contraction rather than any effect on the natural formations shown by colour on the maps and copied by Captain Longfield on his lines of section, is responsible for the great local increases of subsidence. In discussing the problem of the Roman occupation of parts of Southwark and other districts which are now below tide-level, one factor which may be of importance is the presence of deposits of peat in the alluvium over much of the area; the high compressibility of this material is a point to be reckoned with.

Several details of special interest are given in the paper, such as the movements of Waterloo Bridge and the fact that both the Bank of England and St. Paul's Cathedral show slight tilting. The weight of water in the Thames at high tide

causes the tube railway tunnels beneath to assume a slightly elliptical form, but they recover their circular sections at low water. An appendix gives technical details of a new method of transferring levels across water. In view of the interest of the paper, not only to Londoners, but also to those concerned with the technique of levelling or with similar problems of movement throughout the world, it is unfortunate that on Plates IV, V, VII, and VIII there is no direct indication as to where the lines of levels cross the Thames. C. N. B.

ROCK-PEAKS OF THE AHAGGAR MASSIF

Some might feel surprise that the Central Sahara should offer a field to the mountaineer, but an account of a recent journey to the Ahaggar country, by Robert Perret, published in the October 1932 number of *La Montagne* (organ of the French Alpine Club), with its photographic illustrations, shows that in its western parts the Massif contains peaks whose ascent calls for considerable experience of climbing. They are of interest too from the point of view of geology and physical geography, to which due attention is given in the narrative. The special area in question is that known to the Arabs as Kudia and to the Tuareg as Attaqor, an elevated dome-like mass north of Tamanghasset, some 80 km. from north to south, with a steep drop to the north and west. The plateau is broken by faults, which have given passage to volcanic eruptions at various epochs. The cores of the Tertiary volcanoes, laid bare by erosion, now stand out as needles, a notable example of which is the peak of Ilaman, while other elevations are table-topped, the culminating summit, the Tahat, being an old *mesa* reduced to a crest by erosion of its sides. To fantastic shapes is added a variety of colour, from black basalts to rosy phonoliths, the latter formed of nearly vertical prisms. One of the peaks ascended—the Akarakar (2216 m.)—is a colossal dome of trachyte, bounded by a circular cliff, with an explosion-crater in its centre; another—the Tinhamur, the highest point of the Ihagaghen massif (2227 m.)—is an enormous block of granite with no traces of volcanism. Its summit gave a splendid view over the whole surrounding country.

ITALIAN EXPEDITION TO KUFARA AND FEZZAN

Following upon the Italian occupation of Kufara, Professor A. Desio was sent by the Reale Accademia at the head of a scientific expedition to that portion of the Libyan desert, and to eastern Fezzan. We have received from him an extract from the *Memorie geologiche e geografiche di G. Dainelli*, vol. 3 (1932), pp. 111–149, giving a preliminary account of this important journey. Professor Desio left Benghazi in July 1931 by motor for Jalo. Thence the camel caravan set out for Sirhen and Kufara. After a visit to 'Uweinat and Arkenu, the caravan struck west through Busema and Taiserbo for Wau-el-Kebir in Fezzan. Turning northwards, it traversed the Haruj-el-Abiad (or white Haruj) to Temissa. The final stage was the crossing of the Haruj-el-Amed (or black Haruj) *via* El Fogha and Sella to Marada, where the caravan dispersed. The journey occupied four months, the return journey from Kufara to Marada being 1266 kilometres. Much valuable topographic and scientific information was collected, especially geological—for, apart from the specimens brought back by Hassanein Bey, little was known of the geology of this portion of the Libyan desert. Professor Desio compiled a route map based upon compass bearings and the rate of the caravan's march, which fits satisfactorily into the known astronomical positions. He also mapped several of the oases on a large scale. His altitudes, determined by barograph, differ somewhat from those of Hassanein Bey.

Professor Desio then gives a clear and concise summary of the main morphological and geological features of the region. The second of the three zones of

the Libyan desert, the "erg," is not continued into the Fezzan, as are the other two, the "serir" and the "jebel" zones. The "serir" is somewhat modified, not being so level. The Haruj in Fezzan is an elevated plateau overlain with lava, from which its name of "black Haruj" is derived. Its limits are sharply defined on the east and west. Volcanic cones and lava flows are conspicuous, especially the crater near El Namus. The country between Sella and Marada was particularly interesting geologically: the calcareous clays are rich in fossils, and one found there had previously been known only from India and Persia. The population of the Kufara group is provisionally given as 3924, in which the Arabic–Libyan type predominates over the Sudanese and Tebu. This group is the richest in palms in Cyrenaica, the trees numbering 63,000. The olive is also relatively plentiful. The first two oases visited in Fezzan, Wau-el-Namus and El Kebir, were found to be deserted. The largest, Sella, had a population of 1400 agriculturalists.

The collections made by Professor Desio are being examined by specialists, and the complete results are to be published by the Reale Accademia in due course.

RELATIONS BETWEEN MAURITIUS AND EAST AFRICA

We have received from Mr. W. H. Ingrams a copy of a paper by him on points of contact between Mauritius and East Africa, which has been printed in the *Transactions* of the Royal Society of Arts, Mauritius (1932). Mr. Ingrams brings out two points well: the share of Mauritius in the early advancement of British interests in East Africa, and the relations between the Creole and Bantu languages. The first British agent at Zanzibar, an Arab, was appointed by the Governor of Mauritius in 1823. At the same time, the people of Mombasa were in revolt against Seyyid Said of Oman, and appealed to a British naval officer to establish a protectorate, which he did. Though warmly approved by the authorities in Mauritius, partly as an opportunity of checking the slave trade, the project was disowned by the home government. Mauritius has a further link with East Africa, for it was from that island or Bourbon that the clove was introduced to Zanzibar, probably about 1820. The slave trade between the continent and the island was regularized by the middle of the eighteenth century and flourished until the British occupation in 1810. Mauritius was the best market for East African slaves; the traffic was finally ended by a treaty with Seyyid Said in 1822. The main sources were Mozambique, Kilwa, and Zanzibar. These Bantu slaves retained their own methods of thought and of grammatical construction, but were very receptive of new words: consequently Creole has undergone great changes since their advent, its grammar becoming to a large extent Bantu. Mr. Ingams gives many examples of the interaction of the two languages.

GOLD PRODUCTION IN CANADA

During the last few months we have received from the Office of the High Commissioner of Canada bulletins dealing with recent developments in Canadian gold production. The present world situation has doubtless given an impetus to the industry, but the progress recorded extends over several years. The gold production of Canada for the first eight months of 1932 was 2 million ozs., valued at 41·6 million dollars, compared with 1·7 million ozs., of the value of 35·6 million dollars, for the same period in 1931. The Lake Shore mine, in the Kirkland Lake area, Ontario, is the largest producer in the Dominion: its output for recent years has been, in million dollars: 1932, 12·4; 1931, 9·2; and 1930, 6·6. The examination of three new gold areas of considerable promise in Ontario has also been announced, and equally rapid developments are reported from North-West

Quebec. When operations were begun in 1925, the output was 1600 ozs.; for 1932 it is expected that the output will be 430,000 ozs. Other promising areas reported are Island Lake, Manitoba, and Squaw Creek, Tatshenshini river, N.W. British Columbia. A firm has obtained dredging leases for 18 miles of the Fraser river, near Hope, British Columbia.

AMERICAN DESERT MORPHOLOGY

In the *Geogr. Rev.* for October 1932 Professor Douglas Johnson discusses the origin of the "Rock Planes of Arid Regions." These are remarkably smooth surfaces of rock which in the arid regions of the south-western United States and northern Mexico form part of far-spreading lowland plains inclining gently away from the larger mountain masses. The rock-planes, also called pediments or sub-alluvial benches, have been attributed to the erosive action of "sheet floods" when a flooded canyon discharged great volumes of water upon the lowland; and also to wind-erosion. Johnson however has for years been developing and testing a theory that the pediments are the result of normal stream erosion in which lateral cutting plays a relatively important part. According to this the heavily laden streams which issue from the mountains of arid regions do not cut vertically downward to the same extent as the less burdened streams of humid regions, and are far more subject to lateral migrations and interlacing, the effect being to cut back the mountain front, leaving a rock-plane which may be bare or covered with alluvium.

He considers that the theory is greatly strengthened by the fact that he has found in a number of localities just what he had been led to expect would be found, namely alluvial fans, and in many instances naked rock fans, at the mouths of canyons. He shows further that the slope of the rock-plane is always nicely graded or in equilibrium with the streams traversing its surface, which would not be the case had the rock-plane been left by the retreat of a mountain front by weathering. The theory is held to explain many complex relations observed about the borders of desert ranges where, though wind and weather apparently rule to-day, water may have held sway throughout the recent past. The author gives another exposition of his views on the subject in the *Amer. J. Sc.*, vol. 23, 1932.

ORIGIN OF LOESS

In *Gerlands Beitr. Geophys.*, Bd. 35, Heft 2, 1932, L. S. Berg contests the fluvio-glacial or alluvial theory of loess formation, and also the more widely held aeolian or dust theory of Richtofen, maintaining, on the contrary, that it is formed *in situ* from the disintegration of parent rock, being, in effect, a kind of soil produced in dry climates only. Typical loess is a pale yellow, porous, unstratified sediment, rich in silicates and carbonates, and consisting of particles almost uniform in size larger than those of the parent materials which are frequently alluvial and glacial deposits. The latter, which in arid climates weather into dusty loams like loess, in humid climates become heavy clays. It is represented that the parent rocks of the European loesses accumulated chiefly in the glacial period when rivers discharged great quantities of muddy water, and that their transformation into loess occurred in dry interglacial periods or in the dry post-glacial epoch. The main masses of loess in Turkistan and China were also, in Berg's view, formed in a former geological period, and the dust observed by travellers in those regions is derived from loess itself which in intensively cultivated land forms products easily carried away by the wind.

Berg, who presents a well-reasoned case, points out, further, that a full transition of typical loesses into the most diversified loess-like sediments may be

traced. To the latter an aeolian origin is not generally ascribed, so why attribute such to the typical loesses, especially when there is nothing to prove their formation by dust-drift in recent times?

"THUMB-NAIL" MAPS OF ENGLISH COUNTIES

In connection with our recent issue of reproductions of early county maps, Mr. E. G. Box writes to point out that the series of minute maps on the playing cards forming the last sheet of the set has apparently served as the model for the similar maps given with 'A Direction for the English Traviller,' published by Mathew Simons in 1635 and 1636. The size is almost identical in both, and both show the principal towns by their initial letters, but while the playing-card maps (of 1590) mark hills and woods as well as rivers, the later set show rivers only. There are other slight differences, *e.g.* the compass shown in the north-east corner of the earlier maps is absent from all but one—Bedfordshire—of the later, though these retain the lines drawn across the blank spaces round the maps, and corresponding to the four cardinal and four half-points. The numbering of the counties in four groups, equivalent to suits, on the cards is naturally not found in the other set, nor does this have descriptions below the maps, while English counties only are included. In the booklet of 1635 the names of adjoining counties are given on the maps themselves, not below. It would be interesting to know whether the copying (for such it seems certain to have been) was direct, or whether any intermediate issue ever existed. The bare possibility of a now unknown issue of the 'Direction' before 1635 is suggested independently by what looks like an erasure on the engraved title-page of the edition of that year, to which our attention has been called by Mr. H. Whitaker of Halifax. It occurs in the part of the page now bearing the name of Mathew Simons as publisher, the name itself being also rather more heavily cut than the rest of the inscription. It is hardly likely however that an earlier issue should have been completely lost to sight, and instances of alteration of such inscriptions before first publication are not unknown.

THE HOMEM SCHOOL OF CHART-MAKERS

The sale at Sotheby's in 1930 of a previously unknown map by Lopo Homem dated 1519, and the description and reproduction of the same in this *Journal* for March 1931, coupled with the unwarranted (as it seems) denunciation of the map as a modern forgery by Dr. Caraci of Milan, have had this good result, that the attention of students has been focussed on the cartographical work of the Homem family and the life-history of its several members. Besides the discussion by Professor Crinò referred to in the *Journal* for May of last year, the subject has been taken up by Dr. Armand Cortesão of Lisbon, who has been working for some time on a history of early Portuguese cartography, and who in view of the general interest aroused has published in advance, in *O Instituto* of last year, the chapter of his book dealing with the Homems. In preparing this he has made a careful search in the archives of the Torre do Tombo and elsewhere, and has discovered some facts not known before. He first deals with the family as a whole, which was of some importance in Portugal from early times. The story has it that the name originated with a youthful member of the Pereira family, who performed such doughty deeds in battle with the Moors that the king exclaimed that he was not a boy but a man. Dr. Cortesão has found references to many members of the Homem family down to the late sixteenth century, not a few bearing the name Lopo, and in order to decide which of these can be identified with the cartographer he passes in review all that is known of his cartographical output. He fully accepts the genuineness of the 1519 map lately

brought to light, and calls special attention to a passage in the work of the contemporary Portuguese writer Duarte Pacheco, whose views as to the land and water of the globe are so closely reproduced in the Homem map as to suggest that this may have been based on Pacheco's lost map known to have once accompanied the 'Esmeraldo.' Dr. Cortesão is able to add one more to the surviving examples of Lopo Homem's work, as he proves almost conclusively his authorship of the chart preserved in the National Library in Lisbon, hitherto wrongly ascribed to Pedro Reinel. Its date may be placed between 1535 and 1540. A curious point noticed is the reappearance, in Dr. John Dee's MS. map of *c.* 1580 in the British Museum, of the nomenclature of the Baltic region already found in the Lisbon chart.

Recurring to the various members of the Homem family mentioned in the Lisbon Archives, Dr. Cortesão shows much skill in disentangling the cartographer Lopo from the five or six others bearing the same name, and also in demonstrating that all the maps known to us attributable to a Lopo Homem are the work of one man. He has found his actual signature at various dates from 1526 to 1554 in virtually identical form, and his status as Cavalheiro of the Royal Household is another means of distinguishing him from others of his name. There can be no doubt of the important place due to him among the early Portuguese chart-makers.

The monograph deals also, at less length, with the works of the other two cartographers of the name, Diago and Andre, and is well illustrated by photographic reproductions.

OBITUARY

GENERAL NICOLA VACCHELLI

The untimely death of General Vacchelli is a grave loss to his country and a grief to his very many scientific friends all over Europe, for in the Triennial Assemblies of the International Union of Geodesy and Geophysics and in the Conferences of the International Geographical Union he had played a leading part and gained the warm affection of all his colleagues.

Nicola Vacchelli was born inCremona in March 1870, the son of a distinguished physician and politician, and he was given his first commission in the Italian Artillery in 1890. He was early attached to the military geographical service of his country, and came to England in 1909 as Adjutant to General Gliamas, who was the principal Italian delegate to the meeting of the old International Geodetic Association held that year in London and Cambridge. At the entry of Italy into the Great War he was in charge of the cartographical service of the Army and later a member of the Central Military Organization in Rome. In 1919 he was promoted General and given the direction of the Istituto Geografico Militare at Florence. In a short time he succeeded in re-creating this Institute, whose trained personnel had suffered severely during the war, and it fell to him to provide and train the expert staffs required for the many Commissions of boundary delimitation and demarcation which were at work on new frontiers during the next few years.

Under his enthusiastic direction the Institute at Florence became much more than the usual military cartographic institute: a centre of geographical studies, promoting lectures by explorers and travellers, publishing the well-known journal *Universo*, and opening its rich library to all geographical students. With

the collaboration of the late Professor Marinelli, General Vacchelli organized in 1921 the VIIIth National Geographical Congress in Florence, and took an active part in the meetings at Genoa, Milan, and Naples which followed. He was President of the Italian National Committee on Geography, and in 1928 was entrusted with the reorganization of the Royal Italian Geographical Society. In 1928 also he presided at the Conference of Official Delegates for the International Map on the scale of 1/Million which met at the House of our Society, and immediately afterwards presided over the International Geographical Congress in Cambridge where he was among those who received the Degree of Honorary Doctor of Science.

Following on his responsibilities for the 1/Million sheets covering Italy he took up with great enthusiasm the project of the special edition to illustrate the extent and the works of the Roman Empire; and it was a tragic coincidence that the Commission for the preparation of this map was assembling in Rome at the moment of his death. At the Assemblies of the International Union of Geodesy and Geophysics he played a prominent part as the principal delegate of Italy, was a Vice-President of the Union, and a Member of the Executive Committee. His British colleagues who worked with him at the successive meetings in Rome, Madrid, Praha, and Stockholm will retain a vivid recollection of his alert, vigorous, and most charming personality.

His services to his country ranged over a far greater sphere than that of his scientific duties. He was an active member of the first Fascist parliament, was for several years Reporter of the military financial budgets, and was very influential in all military questions which came before the Chamber. This great public activity necessarily limited his original contributions to geography, but no man contributed more by his powers of organization, his energy, his well-balanced judgment, and, above all, his generous enthusiasm. Our Society owes to him a particular debt for his help in two important enterprises. When we obtained permission from Prince Corsini to reproduce his celebrated Portolan Chart, General Vacchelli persuaded the Prince to allow its removal to the studios of the Military Institute where Messrs. Alinari could do their technical work under the best conditions; and more recently the reproduction of the celebrated Catalan World Map of the Biblioteca Estense at Modena was carried out with the same facilities. The work could have scarcely been done without his friendly assistance.

In 1925 General Vacchelli was created an Honorary Corresponding Member of our Society and became an Honorary Member on the occasion of the Centenary. He died in Florence on November 19 of pneumonia following influenza, and thus untimely his country lost one of her ablest and most devoted citizens.

The Editor is indebted to the Cavaliere Filippo De Filippi for much of the above notice.

HENRY OGG FORBES

By the death of Dr. H. O. Forbes, which occurred on October 27 last at Selsey, our Society loses one of its older Fellows. Having been a Fellow since 1883 he served on the Council from 1917 to 1922, and was the recipient of the Gill Memorial in 1893. During the latter part of the last century Dr. Forbes was very well known as an indefatigable explorer and naturalist, but for some years past he had been in very bad health and had lived a life of seclusion.

The second son of the Rev. Alexander Forbes of Dunblade, Aberdeenshire, he was born on 30 February 1851, and educated at the Aberdeen Grammar School, and subsequently at the Universities of Aberdeen and Edinburgh.

Destined for the medical profession, he was compelled to abandon that career owing to the accidental loss of an eye shortly before he was due to qualify. His earliest travels were in Portugal, where in 1875–7 he was making biological and geological investigations. In 1878 he started for the East, where he remained for five years, visiting, exploring, and collecting in the Cocos Keeling Islands, Java, Sumatra, Banda, Amboina, Timor-Laut, Buru, and Timor. During this period he made considerable collections of birds and other objects of natural history. His collection from Timor-Laut was particularly valuable, as that island was previously quite unknown zoologically. After his return to England he published in 1885 his well-known volume 'A Naturalist's Wanderings in the Eastern Archipelago.'

In 1885–6 Forbes led an expedition to explore Mount Owen Stanley, in New Guinea. He repeated the attempt later, but on neither occasion was successful, though he reached a point within a few miles of the base, and it was left to the late Sir William Macgregor to make the ascent at the end of 1889. Forbes published an account of his two journeys, with a map, in the *Scottish Geographical Magazine* (vol. iv, p. 401).

In 1890 he was appointed Director of the Canterbury Museum in New Zealand, a post which he held for three years. During that period he visited the Chatham Islands and made some important investigations into the extinct birds of both of the Chathams and of New Zealand itself. On his return he read a paper before the R.G.S. on "The Chatham Islands: their relation to a former southern Continent." This was subsequently published in the Supplementary Papers of the Society (vol. iii, p. 607, 1893), and it was on this occasion that he received the Gill Memorial award of the Society. In 1894 Dr. Forbes was appointed Director of the Liverpool Museums. In the winter of 1898–9, with Mr. W. R. Ogilvie-Grant he visited the island of Socotra, which he thoroughly explored and from which he brought home large collections in all branches of natural history.

Forbes's last expedition was to Peru, where he was asked to go by the Peruvian Government to investigate and report on the birds of the Guano Islands and on the industry. His report contained a survey of the islands, of various proposals for the conservation of the birds and the economical working of the guano deposits which had for so long a period been a great source of profit to the Peruvian Government.

He married in 1884 at Batavia, Annabella, daughter of William Keith, of Aberdeen. She accompanied him in most of his travels and was the author of 'Insulinde: the experiences of a Naturalist's Wife in the Eastern Archipelago' and other works. W. L. S.

SIR WILLIAM WILLCOCKS

We regret to record the death of Sir William Willcocks, K.C.M.G., at the age of eighty on July 28 last at the Anglo-American Hospital in Cairo.

While most of his professional career, in which he distinguished himself as the greatest irrigation engineer of his time, was spent in the service of the Egyptian Government, Willcocks also performed very useful work in other parts of the world. On the conclusion of the Boer War he was invited in 1901 by the Government to visit South Africa and investigate the possibilities of irrigation in the Transvaal and Orange River Colony, and on the publication of this report he received the honour of K.C.M.G. Subsequently Sir William drew up reports on irrigation projects in Romania before the outbreak of the Great War, and again as recently as in 1928 in Bengal, where he had received his early training.

On retiring from service under the Egyptian Government in 1908 Sir William Willcocks undertook for the Young Turks the preparation of irrigation projects in what was then known as Turkish Arabia, and his Report, 'The Irrigation of Mesopotamia,' was published three years later. The maps and topographical material collected during the survey of the valleys of the Tigris and Euphrates formed a most valuable contribution to geography and to our knowledge of Mesopotamia. These maps were actually the first accurate maps of the country, and proved of the greatest service to our Expeditionary Force at the outset of hostilities in 1914, and again in the following year, when the British troops advanced against the Turks through the swamps of the Lower Euphrates.

Sir William Willcocks was a Fellow for twenty years, and many will recall his lectures on Mesopotamia before the Society at Burlington House in 1909 and 1910, at the latter of which Sir Colin Scott-Moncrieff contributed some interesting biographical details regarding Willcocks's early career. H. E. W.

MEETINGS: SESSION 1932–1933

Second Evening Meeting, 21 November 1932. The President in the Chair

Elections: Arthur Hugh Garfit Alston; William Ernest Barron, F.S.I., F.G.S.; G. E. Belmont; Miss Rhoda Bennett; John Birch; Ernest William Bliss; Thomas Henry Bower, B.SC.; Miss Barbara Briggs, F.Z.S.; Thomas Anthony Brocklebank, B.A.; Robert Enys Broomfield; Alfred Gordon-Broun; Laurance George Butcher; Major Arthur Crawford Julian Campbell; The Rev. A. H. Candler; Felix Alson Clarke, M.R.S.T.; Lady Clarke; Peter Gordon Clarke; Mrs. L. S. Cobham; Mrs. Gertrude Hida Courage, J.P.; Capt. William John Dickson Cowan; W. Judson Coxey, PH.D.; Flight-Lieut. Henry Iliffe Cozens, R.A.F.; Alexander Cruickshank, M.B., CH.B.; Purnshottam Shambhuras Datar, B.A.; J. J. B. Dempster; The Rev. Edwin Albert Dentith; George Dickinson, B.SC., F.G.S.; Mrs. Kate Wilson Dickson; Lieut.-Col. R. M. Dickson, R.A.M.C.; Charles William Dixon; Ernest Henry George Dobby; William Donkin; Miss Dorothy Mary Doveton; Bernard Bruce Edmonds; C. Howard Ellis; Miss Georgia Engelhard; Samuel Edward Evans; Miss F. M. Exton; William Alexander Fairbairn, B.SC., M.B.O.U.; The Rev. Richard Daunton Fear; Lieut.-Commr. Alec Fearn, R.N.; Frederick Percy Charles Feilmann, A.R.S.M.; Christopher Evelyn Fenwick; Richard Martin Ferguson; Thomas Forman; Ralph Fryer; R. C. Dunn-Gardner, B.A.; Oliver Gatty; The Rev. James Mervyn Glass; Alexander R. Glen; M. R. Goel; Frank Annerley Gordon Paul Gore, D.PH., L.D.; John Neston Gough; Miss Margaret Graham; Charles Francis William Rowley Gullick; Harold Hales, B.SC.; Trevor William Harvey; Kenneth Ernest Heesom, M.A.; Lidj Sirak Waldé Silassé Heroui; J. R. P. Heslop; Miss Violet Mary Heslop; Sub-Lieut. Leonard Charles Hill, R.N.R.; The Rev. F. Reginald Holmes; Mrs. R. P. Horsbrugh; Joseph Arthur Howe; P. A. W. Howe; Alfred Henry Howlett, B.A.; Mrs. Marguerite Gore Imlach; Lieut.-Col. William Rennie Izat, D.S.O.; Commr. Ronald Langton-Jones, R.N.; K. M. Joseph, M.A.; R. J. H. Kaulback; Ernest James André Kenny, B.A.; The Lady Kensington; Capt. A. E. B. Lamble; Robert Edmund Ling; Lieut. Arthur Bertram Longbottom; Ernest Blundell Lye; Colonel A. A. McHarg, R.E.; Sir Hugh McPherson, K.C.I.E., C.S.I., I.C.S.; Eric Lionel Mahar; Thomas Mark; William Hargreaves-Mawdsley; Commr. P. S. E. Maxwell, R.N.; Charles Middleton; Louis Leon Mowbray; Miss Alice Florence Adelaide Mutton, M.A.; Lieut.-Col. Davis

C. D. Munro, D.S.O., M.C., D.C.M.; F. B. Newbould; The Rev. Aubrey Nicholl; Miss Gertrude Patterson; Sqd.-Ldr. Hubert Wilson Godfrey Jones Penderel, R.A.F.; William Dyson Perrins; Roger Gamelyn Pettiward; Patrick Herbert Lort-Phillips; Charles Evelyn Pinel, M.I.M.E., A.I.M.A.; E. G. Ponsonby; Colin Anthony Price; Herwald Ramsbotham; Capt. Leslie Ernest Randall, I.A.; Mrs. Jenny Estberg Read; Peter Harold Redpath; Dr. Rafael Requena; Miss Helen Margaret Reynard; Frederick Henry Reynolds, M.B., CH.B.; William Armitage Roberts; Herbert Edward Cooper Robinson; Philip Henry Sandall, M.A.; Ivan Sanderson; Paul James Sandison; Sinnatamby Poorana Satcunan, B.A.; Capt. Henry Scott; Nina, Dowager Countess of Seafield; Charles Robert Serpell; R. R. Sethi, M.A.; Edward Arthur Alexander Shackleton; Miss Margaret Cicely Simpson, B.A.; Lieut. John Montgomerie Sinclair; Miss Anne Smailes; Major H. S. Lees-Smith; Martin Paske-Smith; The Rt. Hon. Viscount Somerton; Dr. Leonard James Spencer; Major Francis Lee Spratt, M.C.; Dr. Matthew W. Stirling; Edgar Oswald Stocker; Sverre Sturlung; Kenneth Herbert Brett Surman; Francis Sutherland, M.B., CH.B., D.P.H.; J. S. Tetley, M.A.; Mrs. K. H. Penrose-Thackwell; Prof. Andrew Frank Thomas, M.A.; John Lewis Thomas, B.SC.; George W. L. Townsend; John Hanbury Tracy; John Vardy; Angus D. Vickers; Vassal Charles Steer-Webster; John Stirling Wells; Mrs. Edward White; Francis J. White; Alexander Ritchie Wighton; D. Williams, M.A.; Lieut. Campbell Aubrey Kenneth Wilson, R.E.; Thomas Claude Middleton Winwood; Robert Horton Vernon Wragge

Paper: The Island of Malekula, New Hebrides. By Miss Evelyn Cheesman

Third Evening Meeting, 5 December 1932. The President in the Chair

Elections: W. J. Arkell, B.A., B.SC., D.PHIL.; Vincent George Best; Oliver Louis Brend; Dorothy, Lady Clayton-East-Clayton; Ernest Lisle Cocking, F.I.C., F.R.E.S.; D. K. Field; Hugh Holman; W. A. McClaughry, D.S.O., M.C., D.F.C.; Horace S. Mazet; Alan Charles Moyle; Group-Capt. R. E. C. Peirse, D.S.O., A.F.C.; Capt. Walter Michael Hungerford Pollen; Group-Capt. C. F. A. Portal, D.S.O., M.C.; Capt. Edmund Meysey Thomas; Henry John Treby; Mrs. Caroline Turner; Francis Wilfred White

Paper: Tierra del Fuego. By Colonel C. W. Furlong

Second Afternoon Meeting, 12 December 1932. The President in the Chair

Paper: The Scientific Results of the Wegener Expedition to Greenland. By Dr. Ernst Sorge

Fourth Evening Meeting, 19 December 1932. The President in the Chair

Elections: C. G. Caiger, B.A.; Peter Fleming; Miss Anne Hawley; E. O Hoppé; Mrs. Herbert Jones; William Percival Lawton, B.A.; John Reeve Lindley; Lieut. Eric Roland John Oddie, R.N.; Miss M. McKinnon Wood

Paper: Great Routes of the Sahara, Past and Future. By H.R.H. Prince Sixte of Bourbon

This map is based on Mr Philby's plottings of his compass traverse, on the scale of 1/158,400, adjusted to his astronomically determined latitudes at the points indicated.
Heights, in feet, are from aneroid readings, and must be taken as approximate.

Arabic Glossary

Ain, plural Ayun	= *Spring*
Arg, plural Urug	= *Sand dune range*
Bir	= *Well*
Ghadir, plural Ghadran	= *Water hole in stream bed*
Harra (t)	= *Volcanic debris*
Hidba (t)	= *Plain*

46° 48°

RABIA

AL KHALI

by

J. B. PHILBY, C.I.E.

1932

Scale 1:2,000,000

0 10 20 30 40 50

Statute Miles

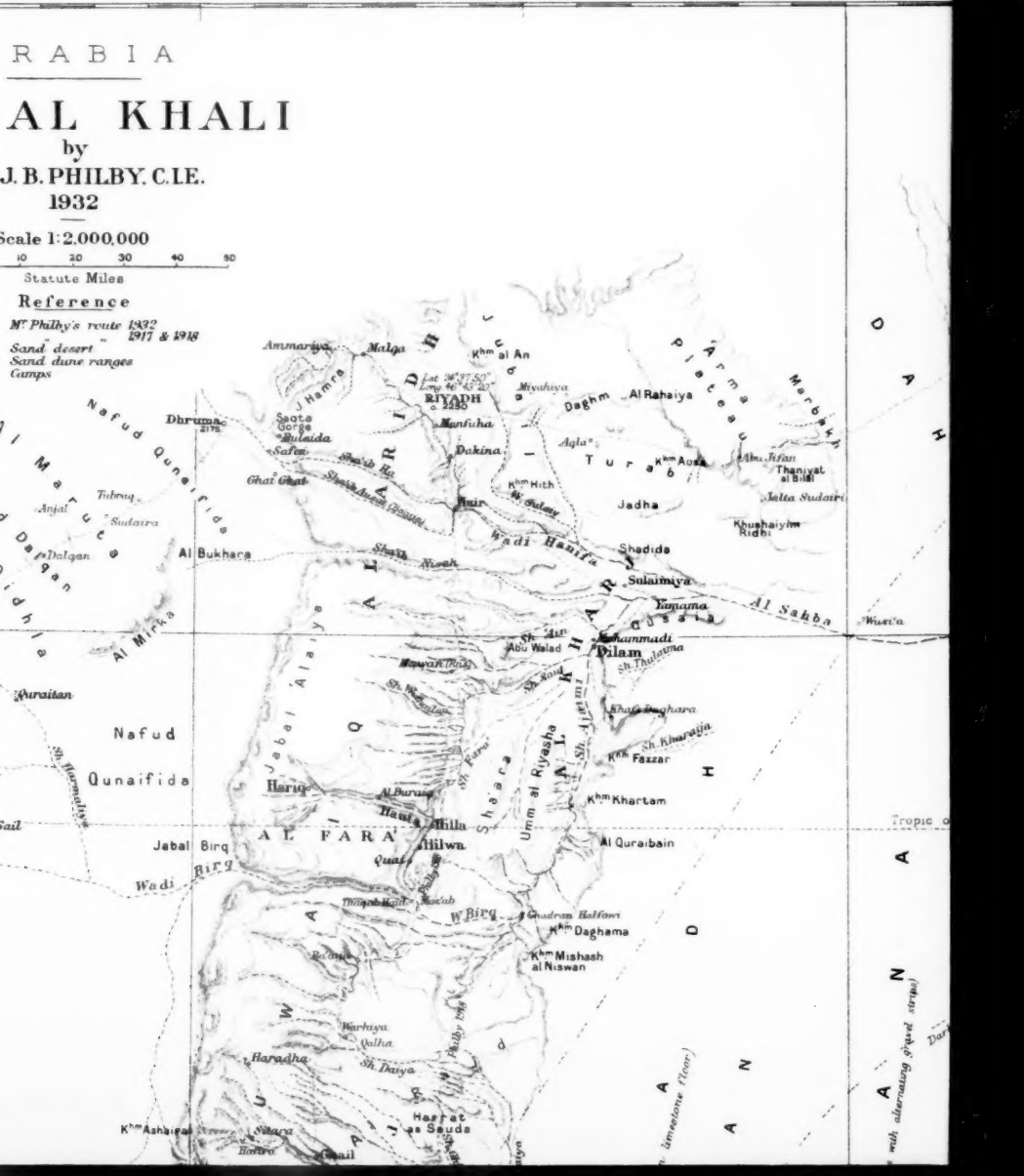
Reference

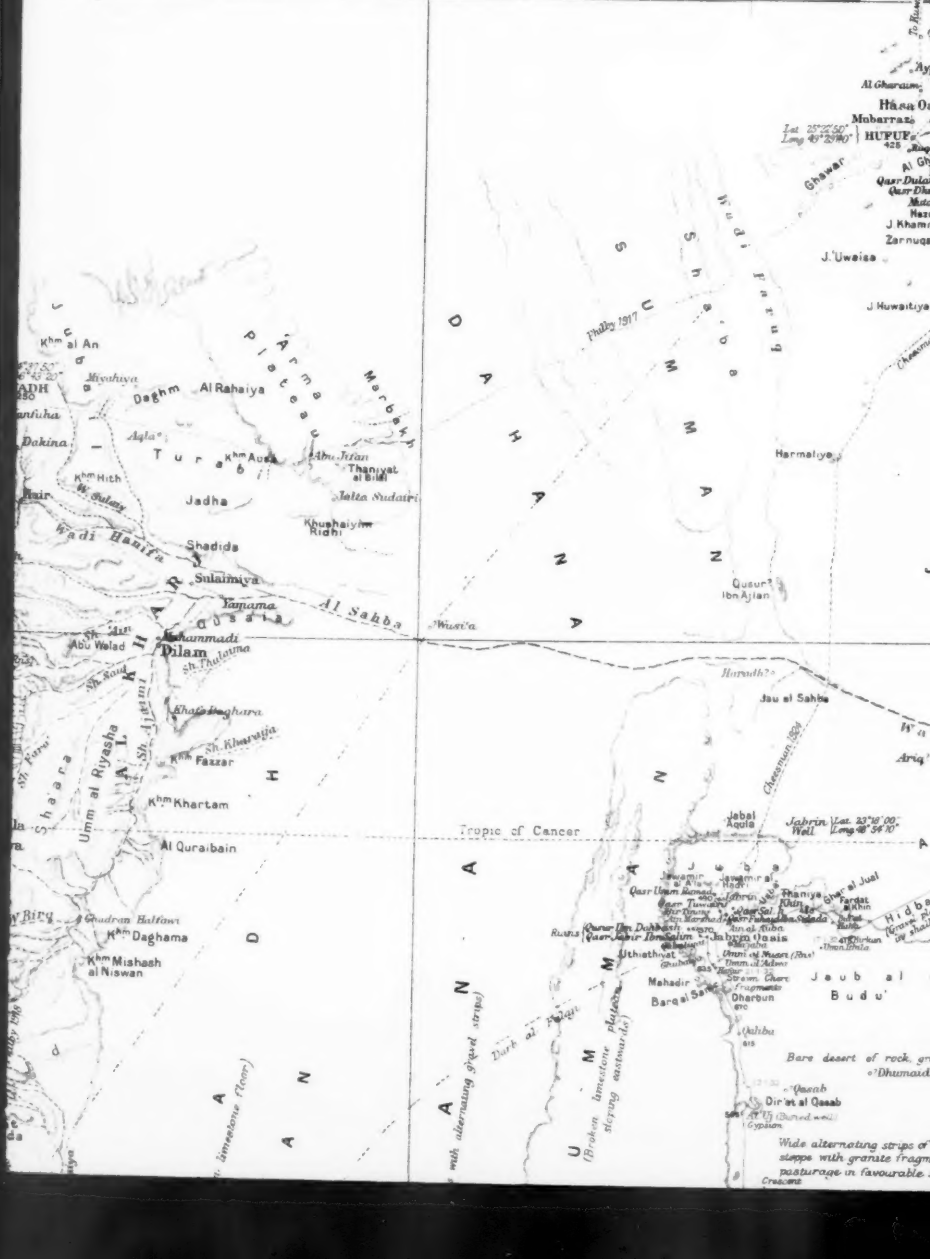
Mr Philby's route 1932 1917 & 1918

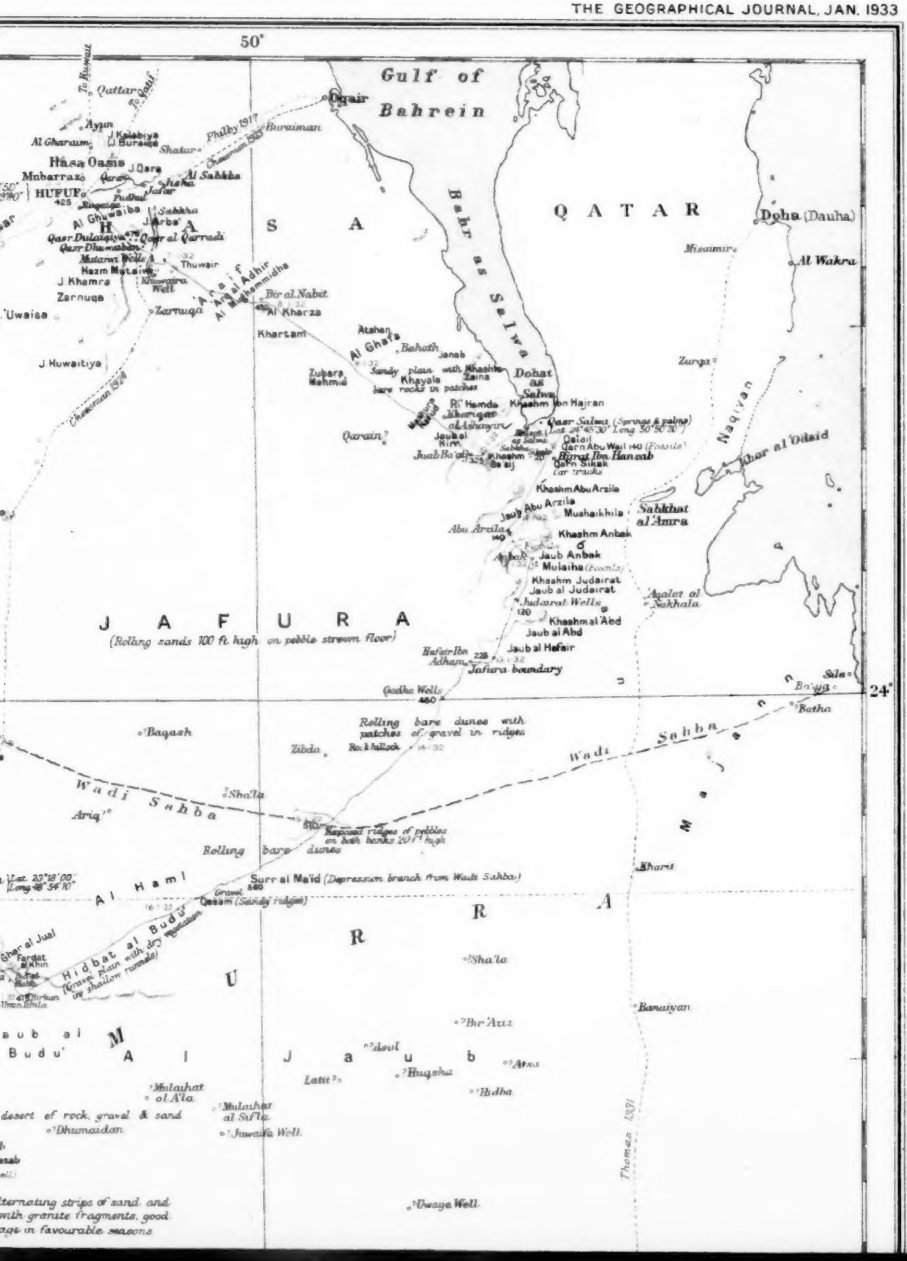
Sand desert

Sand dune ranges

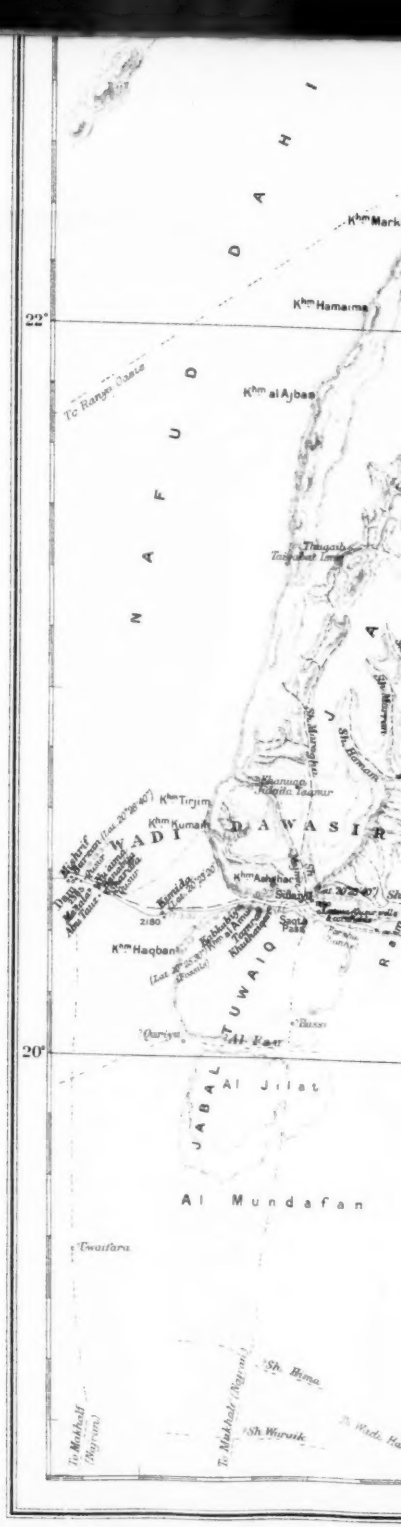
Camps

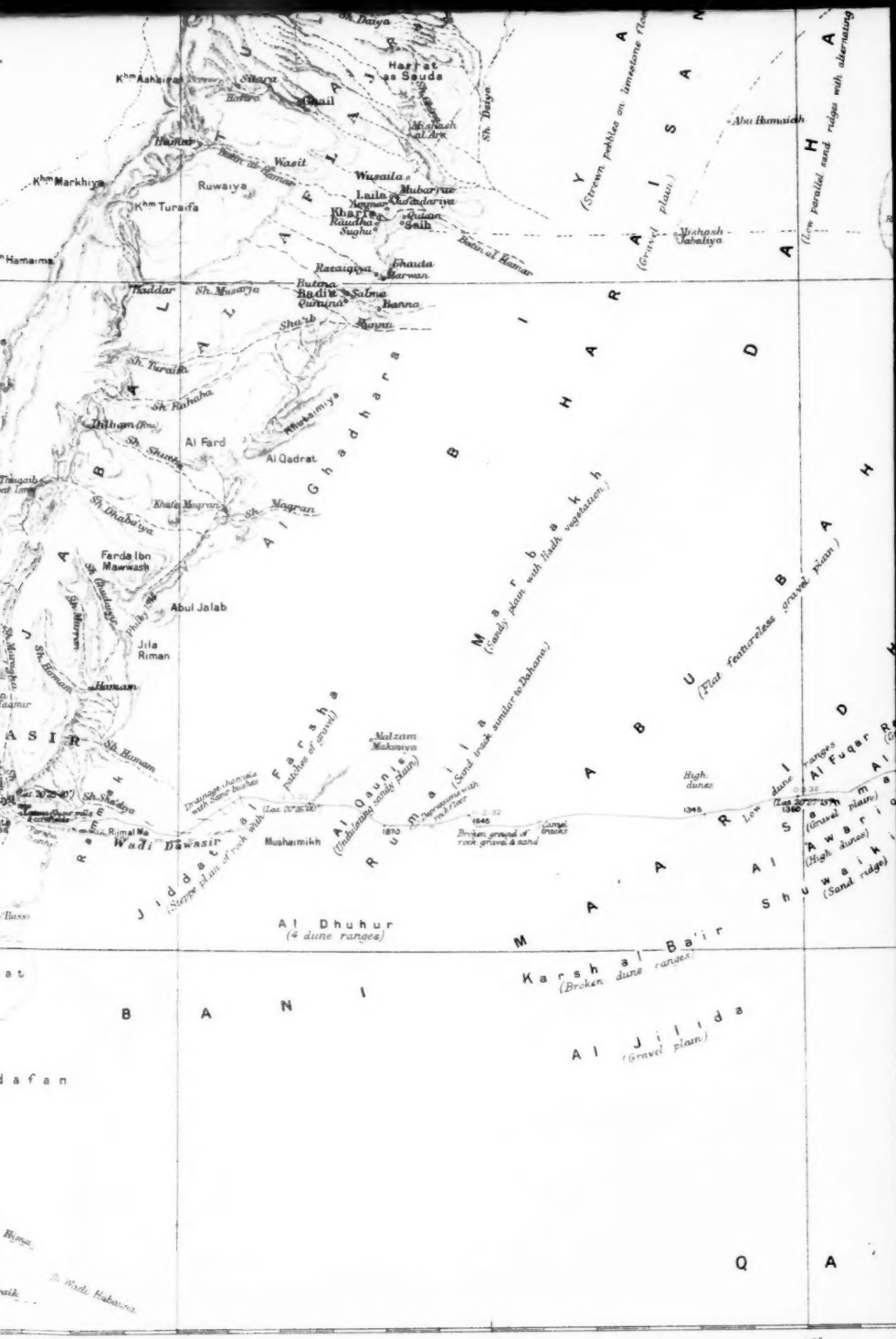

Ammariya
Malga
Khm al An
Miyahiya
Daghm
Al Rahaiya
Marbakh
Dhruma
Sata Gorge
Sulaida
Safen
Manfuha
Dakina
Aqla
Khm Aosa
Thaniyat al Bilid
Jalta Sudairi
Ghat Ghat
Khm Hith
Jadha
Khushaiyim Ridhi
Tabrag
Anjal
Sudaira
Dalgan
Al Bukhara
Shadida
Sulaimiya
Yamama
Al Sahba
Wusta
Al Mirka
Abu Walad
Pilam
Muraitan
Nafud
Qunaifida
Khaf Baghara
Khm Fazzar
Khm Khartam
Tropic o
Jabal Birq
Al Quraibain
Wadi Birq
W Birq
Khm Daghama
Khm Mishash al Niswan
Warhaya
Qalha
Haradha
Sh Dariya
Khm Ashaira
Hasrat as Sauda
Buraida
Qasim
Ha'il
Jubbah
Shinan
Aja
Salma
Tuwaiq
Jabal Aja
Jabal Shaara
Umm al Riyasha
Sh Faraj
Sh Jaramil
Sh Khaiyaja
Sh Thalatha
Sh Ain
Sh Kaiq
Sh Hamaliya
Sh Tabalan
Sh Ghadaf
Sh Ghadaf
Sh Ghadaf

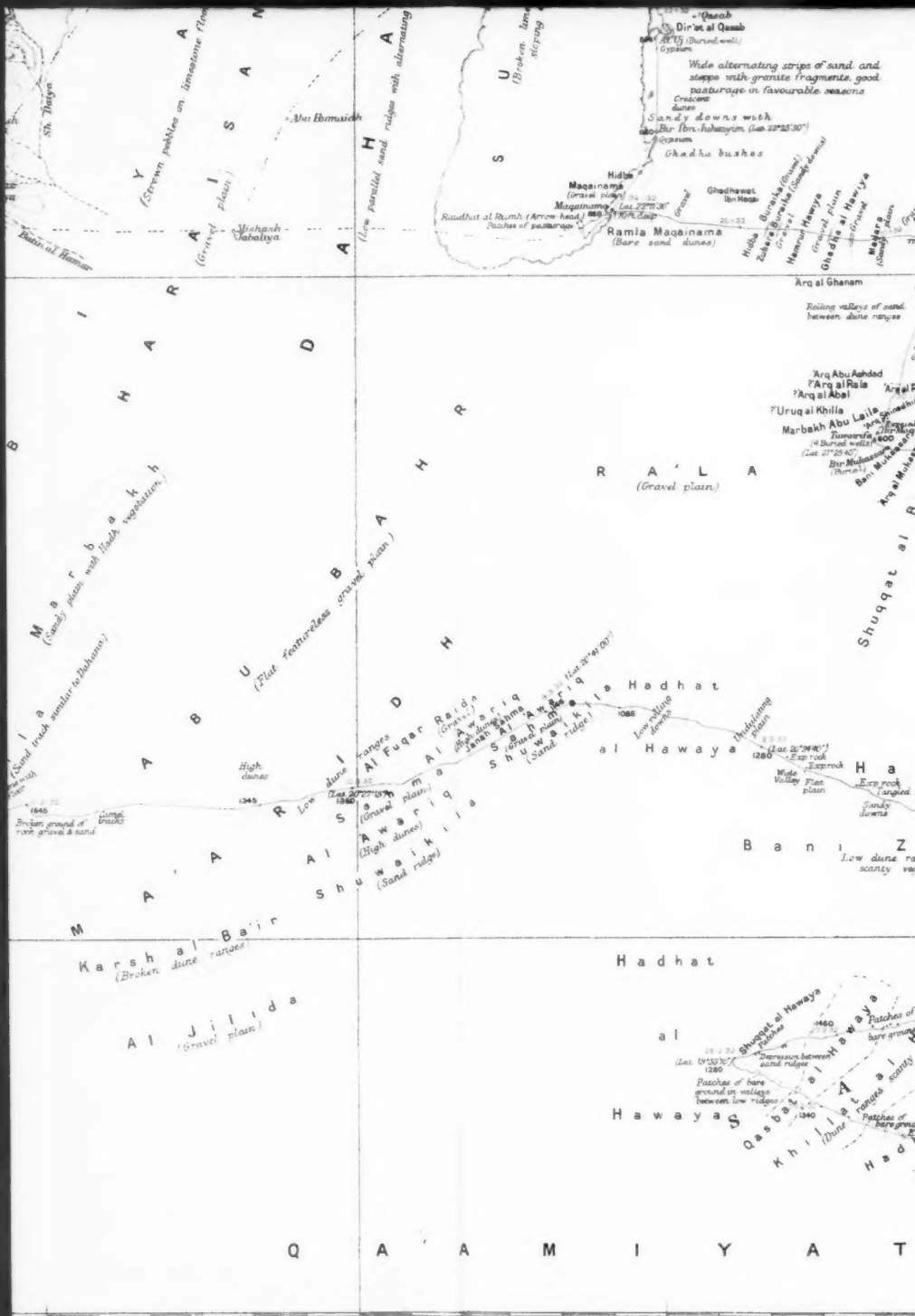

Khm al An
Miyahiya
Daghm
Al Rahaiya
Dakina
Aqla
Khm Hith
W. Sulaiy
Jadha
Shadida
Sulaimiya
Yamama
Khm Aus
Abu Jifan
Thaniyat al Bilal
Jalta Sudairi
Khushaiyim Ridhi
Wadi Hanifa
Al Sahba
Khm Abu Walad
Khammadi Dilam
Sh Fulaitma
Shafa Ghara
Sh Kharaija
Khm Fazzar
Khm Khartam
Al Quraibain
Umm al Riyasha
Sh Jarami
Sh Kuwa
Sh Furu
Shaara
Qudran Balfaqi
Khm Daghama
Khm Mishash al Niswan
Limestone (Eocene)
Tropic of Cancer
Jabal Aqda
Jabrin Well
Lat. 23°16'00"
Long 49° 56'10"
Jau al Sahba
Hurudh?
Chesmann 1931
Wusi'a
Qusur Ibn Ajlan
Harmaliya
Phillips 1917
Wadi Fatma
Shaiba
Ghawar
J. Uwaisa
J Huwaitiya
Al Gharaum
Mubarraz
HUFUF
425
Qasr Dulaim
Qasr Dhu
Zarnuqa
Jabrin Oasis
Qasr Ibn Dukhaish
Qasr Jabir Ibn Salim
Uthaithiyat
Mahadir
Dhurbun
Qahba
Barqa al Safa
Dark al Hajar
Jaub al Budu'
Bare desert of rock, gr
Dhumaid
Qasab
Dir'at al Qasab
Gypsum
Wide alternating strips of
steppe with granite fragm
pasturage in favourable
Crescent
Limestone (Eocene)
with alternating gravel strips
Upper limestone plateau
(Broken limestone
sloping eastwards)


50°
Gulf of Bahrein
Dohat as Salwa
Bahr as Salwa
Q A T A R
Doha (Dauha)
Al Wakra
Dukhan
Zubara
Ruins
Qatar
Dohat Salwa
Khashm Ibn Hajran
Qasr Salwa (Springs & palms)
Lat. 24° 45'30" Long. 50° 50'20"
Qarn Abu Wail 140 (Fossils)
Qarn Sikak
Car tracks
Khashm Abu Arzila
Abu Arzila
Sabkhat al Amra
Khashm Anbak
Jaub Anbak
Mulaiha (Fossils)
Khashm Judairat
Jaub al Judairat
Judairat Wells
Khashm al Abd
Jaub al Abd
Jaub al Hafair
Jafura boundary
Qadha Wells
460
J A F U R A
(Rolling sands 100 ft. high on pebble stream floor)
Rolling bare dunes with patches of gravel in ridges
Rock hillock
Wadi Sabha
Sha'la
Ariq
Maximal ridges of pebbles on both banks 20 ft. high
Rolling bare dunes
Al Haml
Surr al Maid (Depression branch from Wadi Sabha)
Gravel
Qassam (Sandy ridges)
Hibbat al Budu' (Gravel plain with dry water-courses)
Al Budu'
Bir 'Aiz
Idol
Huqsha
Ibdha
Atras
Banuiyan
Khors
Batha
Sila
Bayya
24°
Thomas (1931)
Dhumaidan
Jiwaifa Well
Uwaya Well
Qarn Sikak
Khor al Udaid
Nagiyan
Misaimir
Zurqa
Qarain
Khaiyala
Khashm Zaina
Khashm al Khamgar
Jaub al Rima
Jaub al Hafair
Adham
Abu Arzila
Mushaikhila
Anbak
Judairat
Khashm al Abd
Jaub al Abd
Agalat al Sakhala
Khashm Abu Arzila
Sabkhat al Amra
Khashm Anbak
Khashm Judairat
Khashm al Abd
Jaub al Hafair
Jafura boundary
Qadha Wells
460

	Ain, plural Ayun	= *Spring*
	Arg, plural Urug	= *Sand dune range*
	Bir	= *Well*
	Ghadir, plural Ghadran	= *Water hole in stream bed*
	Harra (t)	= *Volcanic debris*
	Hidba (t)	= *Plain*
	Hugna	= *Crescent sand hill*
	Jabal	= *Mountain, hill*
	Jau	= *Wide valley*
	Jaub, plural Jiban	= *Depression, hollow*
	Khafs	= *Pond in natural cavity*
Khm	*Khashm*	= *Peak, headland*
	Khilla (t)	= *Region without Hadh vegetation*
	Marbakh	= *Flat sandy pasture land*
	Mishash	= *Exiguous water in sandy ground*
	Qarn, plural Qurun	= *Projecting hill*
	Qasr, plural Qusur	= *Fort*
	Qaux, plural Qizan	= *High round sand hill*
	Ramla (t)	= *Rolling sand hill*
	Sabkha (t)	= *Saline depression*
Sh.	*Sha'ib*	= *Dry water course*
	Shuqqa (t), plural Shiqqy	= *Wadi like depression in sands*
W.	*Wadi*	= *Dry river bed*




Hasrat as Sauda
Hail
Ha'il
Wasit
Wusaita
Laila
Mubarjaz
Khafra
Sudan
Salb
Ruwaiya
Khm Markhiya
Khm Turaifa
Hamaima
Rawaiqiya
Ghauda
Marwan
Butena
Salma
Qurayna
Hanna
Shu'ab
Taddar
Sh. Turaifa
Sh. Ruhaba
Al Fard
Al Qadrat
Sh. Dhahabiya
Khafs Magran
Magran
Farda Ibn Marwash
Abul Jalab
Jila Riman
Humam
Sh. Humam
Malzam Makuniya
Wadi Dawasir
Rimal Sa
Mushaimikh
Al Dhuhur
(4 dune ranges)
Karsh al Ba'ir
(Broken dune ranges)
Al Jilida
(Gravel plain)
Abu Humaiah
Yishash Jabaliya
Sh. Daiya
Sh. Dariya
Sh. Musaiya
Sh. Maqran
Sh. Humam
Sh. Hadiya
Sh. Rimal
Sh. Wadi Hubaina
Jilham (Res.)
Khafs Maqran
Tuwaiq
Jubaila
Riyadh
Dilam
Hotat Bani Tamim
Tayasir
Jaynur
Bassr
Dafan
Rima
Wasit
Ruwaiya
Khafra
Sudan
Salb
Butena
Salma
Qurayna
Hanna
Ghauda
Marwan
Rawaiqiya
Taddar
Sh. Musaiya
Sh. Turaifa
Sh. Ruhaba
Sh. Shuttla
Sh. Dhahab



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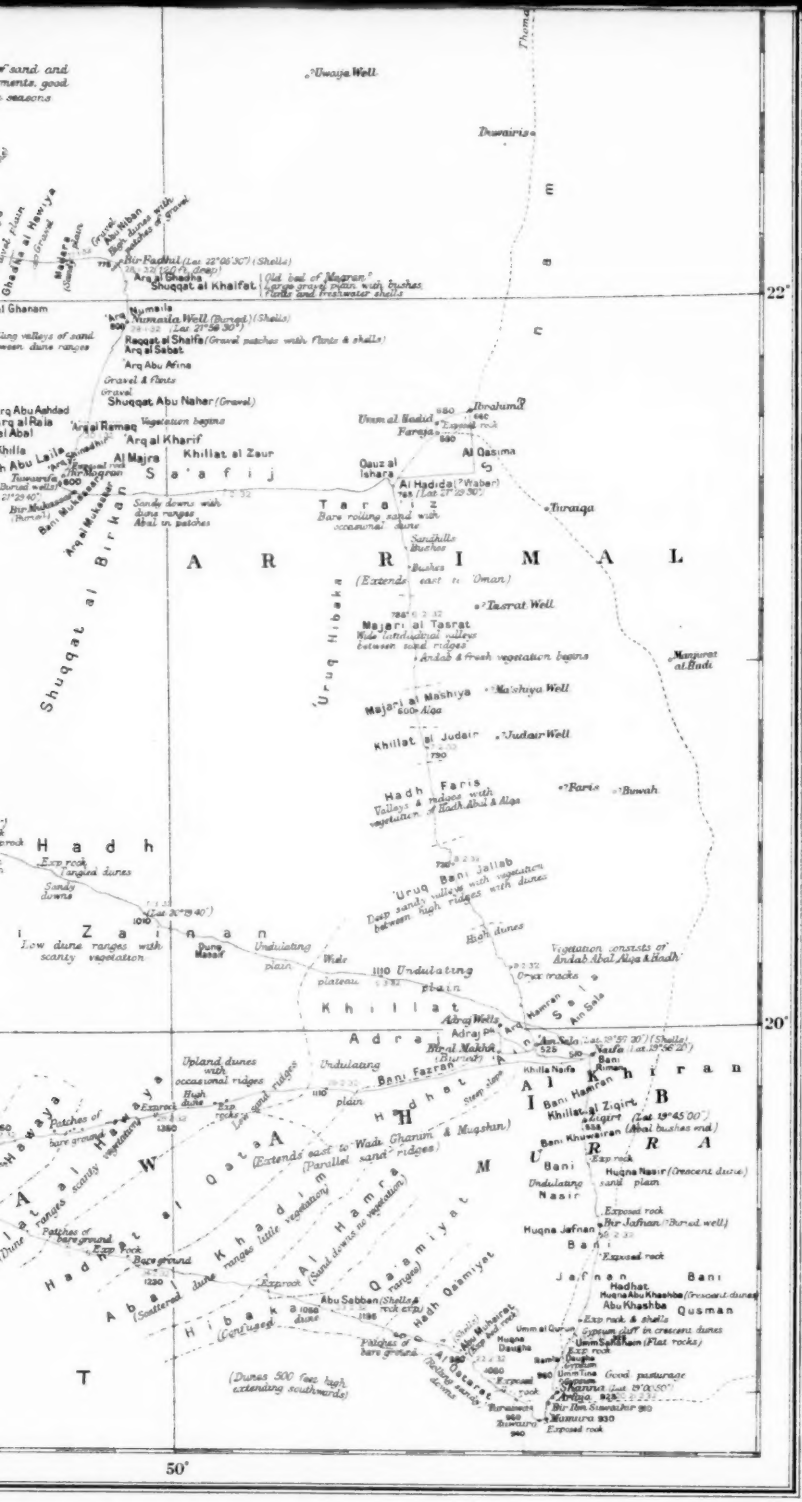

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